LONG-TERM IMPACT OF INTERACTIVE SCIENCE EXHIBITS

by

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Abstract

In this study, the *long-term* impact on family groups of the interactive science exhibits in Launch Pad (Science Museum, London) has been investigated and described both qualitatively and quantitatively. Having reviewed the literature, and sought the views of professionals working in interactive science centres, a series of research questions was evolved. It is argued that it is reasonable to use visitors' recollections of their visits in order to assess this long-term impact.

Altogether, 20 subjects were observed in Launch Pad, 396 were given an interview immediately after their visit, 208 responded to a follow-up questionnaire, and 79 were given an in-depth interview about 6 months later.

Various *indicators* have been defined in order to quantify the differences that exist between interactive exhibits, and the concept of *exhibit profiles* has been introduced as a way of graphically representing these differences. The exhibits were found to hold the attention of visitors, and there was little evidence of *museum fatigue*. Subjects reported almost unanimously that they had enjoyed their visit and that Launch Pad had made a large positive impact the effects of which lasted for at least six months.

Visitors were able to recall in vivid and clear detail their experiences in Launch Pad six months later. A new method of analysing their diverse and scattered recollections was evolved by the development of a network and coding strategies. Although 59% of the elaborated memory comments were found to be descriptive, there were nearly twice as many thoughts as feelings. Also, the data showed that visitors had reflected on their experiences and related them to existing knowledge or, for example, to programmes they saw on television. Evidence of subsequent cognitive processing suggests that a visitor embarks on a process of learning and understanding following an enjoyable, inspiring and thought-provoking visit.

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Dedication

This thesis is dedicated to my wife and children who were forced to make unreasonable sacrifices. Only with their understanding and support was this thesis finished.

Acknowledgements

I am grateful to the Science Museum for supporting my part-time research whilst I was on their staff and to the Commonwealth Institute for continuing to support my studies.

I thank all my colleagues and friends who have assisted me with much kindness during the collection of data, its analysis and discussion, and the writing of this thesis.

I am particularly grateful to Prof Jon Ogborn who supervised and guided my studies, and who brought clarity and many insights to my research.

I remember with sadness and fondness my friend and colleague, the late Aubrey Tulley, who was also researching into interactive exhibits but who died unexpectedly before completing his studies. We had many stimulating discussions and arguments, and I acknowledge and miss his kindness and encouragement.

CHAPTER 1 INTRODUCTION

1.1 Impact

The Science Museum hopes that its interactive technology centre, Launch Pad, will have an **impact** on its visitors - that in some way they will be changed by their experiences there. This effect can be clear, dramatic and two-way - hence the use of the word impact. Visitors do have an effect on Launch Pad itself, not only by wearing exhibits out by their enthusiastic use of them but by helping good exhibits to evolve (and bad ones to disappear) through a process of feedback or formative evaluation.

Impact implies something striking and memorable. Therefore the work in this thesis examines whether there is indeed an impact when Launch Pad and its visitors come together. Also, it describes qualitatively, and quantifies certain aspects of whatever long-term impact there is. In particular, in this research, I am interested in how memorable an experience in Launch Pad can be.

1.2 Launch Pad

Launch Pad is the Science Museum's interactive technology gallery which opened in July 1986 with about 65 interactive exhibits and covered 900 square meters. It was first positioned on the ground floor of the museum adjacent to the main door. As part of the major refurbishment of the entrance to the museum, Launch Pad was subsequently moved to the first floor immediately above its old position. The data used in this research were collected whilst Launch Pad was in its original position on the ground floor.

The Science Museum (or more correctly, the National Museum of Science and Industry) collects, conserves and displays material connected with the history and development of

science and technology. Through its displays the Science Museum also promotes an understanding of the history of science and industry and their effects on our lives. A good example of this educational role of the museum is the Children's Gallery which opened in the early 1930s. There are many in this country who can remember at some point in their childhood coming to the Science Museum and pushing all the buttons. Nowadays, the Science Museum also invests in an educational programme using actors, demonstrators and education officers which provides a range of services and resource materials for those using the museum, particularly those coming in school groups. Working demonstrations and exhibits form an important part of the existing displays and the Science Museum has continued to develop their use, and to introduce examples of new technology such as laser disc.

As part of this process of evolution the Science Museum decided to build a gallery devoted to interactive exhibits. In June 1981 the Ontario Science Circus visited the Science Museum. This had a considerable impact not only on the Science Museum visitors but also on its staff. An evaluation of their visit was carried out (Gillies & Wilson 1982) and provided further evidence that a permanent interactive exhibition was needed. A series of Discovery Rooms, provided by the Education Department of the Science Museum, the first in August 1981, demonstrated very clearly how visitors enjoyed being able to handle objects and do experiments for themselves.

With the assistance of considerable grants from the Department of Industry (as it then was) and the Leverhulme Trust, the Science Museum developed its permanent interactive centre.

It immediately became apparent that Launch Pad was going to be extremely popular. Even if the rest of the Science Museum appeared deserted, one could be sure that there would be many people in Launch Pad. A ticketing system was established: at busy times visitors come to the Launch Pad entrance desk and receive a ticket with a time on it at which they can get in. This enables them to look around the rest of the museum instead of queuing. It is estimated that up to 2,500 visitors can visit Launch Pad in an 8 hour

day, which gives a theoretical maximum of 800,000 visitors a year.

Launch Pad was the first permanent interactive technology centre to open in the UK. Since 1986 many other centres have opened, for example the Exploratory in Bristol, Techniquest in Cardiff, Xperiment! in the Greater Manchester Museum of Science and Industry and Light on Science at the Birmingham Museum of Science and Industry. Discovery Dome is a travelling interactive centre that travels the country in brightly coloured geodesic tents. It was one of the conditions of the grant from the Department of Industry that information should be made available to other groups in order to help them to build interactive exhibits cheaply.

The name Launch Pad was chosen to reflect the Science Museum's hope that, for some visitors at least, the exhibition would ignite new interest, setting them off in new directions and perhaps leading some young people to consider a career in industry or technology. This name however has led to some confusion as many people expect the exhibition to be somehow connected with space.

The Science Museum has described Launch Pad as an exhibition where

> .... the emphasis is on participation, discovery, and having fun. Its exhibits have been chosen around the broad theme of 'technology'. They provide many exciting opportunities for exploring how and why things work, and experiencing fundamental scientific ideas which have widespread technological uses.

Launch Pad is not just about exhibits. There are staff available in the exhibition who mingle with the visitors, answer queries, help them and generally act in the way a host does at a party. Their role is very different from that of the usual type of museum warder. Their presence produces a welcoming atmosphere and enhances the visitors' enjoyment of the exhibition, but it also makes it possible to include exhibits which would never survive in the traditional museum gallery because of the risk of misuse, injury to the visitor or pilferage.

At any one time Launch Pad has about 65 exhibits in it, but exhibits are replaced from time to time. Throughout the period during which data was collected about 80 different

exhibits were available to be interacted with. Naturally not all of these were available at any one time and a few of them were only there on one or two occasions for testing purposes.

Apart from the roles as described above of the Launch Pad staff, they also have another task of giving demonstrations in Launch Pad on a number of topics. These are often demonstrations of things which were not possible to make into hands-on exhibits. Demonstrations are given on liquid gases and paper making for example. These are also included in the list of exhibits. Each exhibit was given an internal number and these numbers are used throughout this thesis for simplicity. As many original ideas and trial exhibits did not proceed to production there are gaps in the numbering system. Appendix A gives brief details of each of the exhibits in Launch Pad which were available throughout the data collection period, together with their titles (which were usually displayed on a *flag* above the exhibit).

1.3 Why this Research

As Education Officer at the Science Museum from November 1979 to February 1990 I was very much involved with the early development of Launch Pad, such as the setting up and running of the Discovery Rooms, and then the devising and setting up of Launch Pad itself. My colleagues (Anthony Wilson, Head of Education, and the late Aubrey Tulley, Education Officer) and I formed a team which provided the educational direction for the whole project. We devised the overall strategy, organised the selection of exhibit ideas, supervised their evaluation, recruited the Launch Pad helpers and established day-to-day working practices. A second team dealt with the development of exhibits and a third team did the final design and production of exhibits and the gallery itself. More details of the way Launch Pad was established are given by Wilson (1987).

When Launch Pad was being established very little research had been carried out on interactive science and technology centres. Therefore it seemed appropriate that I should

undertake some part-time research which was very much relevant to my work duties (i.e. Launch Pad), particularly as I was so interested to find out more about the inner workings of interactive science and technology centres (ISTCs). The Science Museum was persuaded that the benefits accruing to itself and to me due to the potential increase in knowledge and effectiveness were sufficient to fund my part-time research studies at the University of London Institute of Education under the tutorship of Professor Jon Ogborn.

The Launch Pad Sponsorship Brochure produced in 1983 stated that the aim for the creation of Launch Pad was

> .... to provide a place where people of all ages can discover that exploring and experimenting in technology can be a satisfying and worthwhile experience.

The aims or hopes for Launch Pad were further elaborated and set out in Stevenson (1987a) - see Appendix B:

> The emphasis is unashamedly on enjoyment, and Launch Pad is biased strongly towards technology rather than pure science. However the experience is also designed to be subtly educational; visitors learn without being aware that they are learning. A visit to Launch Pad is also intended to be inspirational; to act as a stimulus and to introduce young people to technology and science and encourage them to pursue these subjects further.

Also, the creation of Launch Pad signalled to its visitors and others that the Science Museum was up-to-date, lively and responsive to audience demand. Museums are increasingly having to come to terms with the fact that they are now to some extent part of the leisure market and that they can no longer look down on their visitors from a position of lofty academic superiority.

Although the exhibits in Launch Pad are the main focus of attention for visitors, an ISTC is more than just a collection of hands-on exhibits. Exhibits are important but the context in which they are set is also of vital importance. This setting and its style is very different from that of the rest of the Science Museum; thus giving a clear signal to visitors that they may touch, handle, take things to pieces and put them back together again - something which is not usually encouraged in a museum. Instead of the uniformed warders who patrol the rest of the Museum there are helpers or explainers whose job it

is to answer questions, encourage exploration and discovery or perhaps just engage visitors in casual conversation. There are areas where visitors can go to get more information about the exhibits and to see demonstrations. The purpose is to create a friendly and informal environment in which the aims of Launch Pad can be achieved.

1.4 Outline of Thesis

Even casual observation of visitors in Launch Pad shows that visitors spend most of their time looking at or interacting with the exhibits. Therefore the main focus of attention of this thesis is concerned with visitors' interactions with the exhibits and the resulting impacts. The research is strongly focused on *family groups*. It is felt that families form the most important and probably the largest group amongst Launch Pad's many visitors, and is also the group the creators of Launch Pad had in mind when it was established. It is also suspected that families gain most from a visit to an ISTC such as Launch Pad.

Chapter 2 looks at some of the relevant literature, which is however scattered and uneven, since research on ISTCs is not well established. It is clear from this review that there are many unanswered questions. By looking at the views expressed by professionals working in ISTCs about what they are hoping to achieve, and what they think they actually do achieve, and combining this with the previous review, a series of research questions was formulated.

A large part of museum research has concerned the actual observed interaction of visitors with exhibits, which is typically quite brief, together with attempts to assess their immediate impact, for example on what visitors talk about. The main innovation in this research is the decision to investigate impact in the longer term. It poses and attempts to answer the question "Do visitors remember Launch Pad exhibits, and if so, in what way?". So to assess the long-term impact that Launch Pad has on its visitors it was decided to interview visitors about six months after their visits. Chapter 3 argues that it is reasonable to use visitors' recollections of their visits in order to assess the impact

which their visit had.

Using the research questions as a starting point, Chapter 4 details how the research was planned and carried out in order to provide some of the answers. This chapter also includes data on what certain people say they expect the results to be.

Chapters 5, 6, 7 and 8 present the data and the analysis of the four main elements of this study: tracking of visitors in Launch Pad, interviewing them immediately after their visit, a follow-up questionnaire sent several weeks later, and a follow-up interview with the same group that had visited about six months later.

The final chapter brings together the above four main strands and relates them to the research questions. Conclusions are drawn and areas of further study suggested.

CHAPTER 2 OVERVIEW

2.1 Introduction

In this chapter, interactive science and technology centres (ISTCs) in general and Launch Pad in particular, are placed within the overall context of developments in museums and informal education, and the views of professionals working in ISTCs are summarised.

There is no established body of literature especially related to ISTCs and what goes on in them, but there is literature in several diverse areas such as psychology, museums, science education, evaluation, sociology, etc which is relevant to this study. This wide-ranging and varied literature has been sampled to show not only that some directly relevant studies have been carried out but also that there are parallels to be drawn in these other fields of study. It is to be hoped that in a short time a body of ISTC literature will form.

Exhibits and displays in museums can be placed in one of three broad categories:

- static
- reactive or participatory
- interactive

These kinds of categories are widely acknowledged but there are sometimes differences in the number of categories and the names given to them. For example, the word *participatory* is sometimes used to refer to exhibits in both the reactive and interactive categories - though not usually by the same person.

The *static* category refers to those exhibits which one normally sees displayed in a traditional museum in glass cases or behind railings. Such an exhibit is often associated with graphic panels of text, photographs and other visuals. It is usually not permitted to touch them and even if you did nothing would happen.

The exhibits in the *reactive* category are ones which react in some way to the visitor. It may be just that a button needs to be pushed to set a demonstration going or a handle turned to operate a model. Alternatively, a visitor may spend many minutes playing with a computer game or simulation as part of an associated display.

Interactive exhibits are not only fully hands-on but are also more open-ended than reactive ones. In Stevenson (1987a) I described the interactive exhibits in Launch Pad as follows:

> Our exhibits are intended to work at many levels. Ideally a four year old and a learned scientist should both be able to get something out of an exhibit - though of course not necessarily the same thing. There is usually no *right* thing to do with it, there are many ways of manipulating it - perhaps finding out things or using it in ways we had not thought of. Visually attractive, the exhibits invite immediate participation. There are no complicated instructions to read - it should be possible to interact with an exhibit immediately and find the experience rewarding. There are some words around but they are discreetly placed to avoid distressing our visitors by intruding upon their enjoyment. Perhaps an older member of the family will read them and pass on some ideas.
>
> The exhibits are fully interactive. They are not just demonstrations which start their fixed performance at the press of a button or models which go though their routine motions at the turn of an handle. The best ones are open-ended; designed to allow the user to explore and investigate the world of technology and science. We hope they will give insights into how and why things work. They are also concerned with the principles of technology and science.

ISTCs usually contain only interactive exhibits. The centre is either a completely separate organisation (such as the Exploratory or Techniquest) or else they are a clearly identifiable separate part of another organisation such as a museum (for example, Launch Pad at the Science Museum, or Xperiment! in the Greater Manchester Museum of Science and Industry).

It is possible to place a number of interactive exhibits in a traditional museum display (this will be termed a *participatory* display) although it is generally recognised that this does not then turn the display into a mini ISTC. As previously mentioned on page 22, the *context* of the interactive exhibits is an important factor for an ISTC; i.e. its physical setting must be appropriate and the presence of friendly helpers or explainers is essential.

In this country ISTCs have only been in existence for about seven years but in North America centres have been in existence for longer; for example, the Exploratorium in San Francisco opened in 1969. There are of course many more participatory exhibitions. As a result there are a number of studies involving interactive exhibits which are not part of an ISTC. It is frequently difficult to assess what the differences to the results of the studies would be if the exhibit had been in an ISTC.

2.2 Professional Views about ISTCs

Without an established literature for ISTCs it was felt necessary to collect *professional* views about ISTCs in order to provide material on which it would be possible to assess what might be the relevant issues which this thesis should address. Professionals are defined to be those people working in an ISTC or closely involved with one. The views of about 20 professionals from centres around the UK were collected from their writings (often unpublished material) and informally through personal contact. I am particularly grateful to those professionals who were also kind enough to comment on an early draft of this section.

This section contains a collection of views about ISTCs held by professionals involved with the development and running of such centres. Here, a *view* is considered to be the collection of theories, opinions and ideas which an ISTC professional holds based on their experience and intuitive assessment of hands-on centres. Due to the lack of much practical research and theorising in this field it is not unreasonable to expect that parts of some views may be rather speculative.

There are many views about Launch Pad, and other ISTCs. These views have not all been clearly defined; some have been clearly expressed on paper although many have only been expressed verbally in an informal way. Professionals' views are also usually in a state of change as more experience brings fresh insights.

In the pioneering days of developing ISTCs the emphasis has been on getting them to open, rather than on formulating a consistent philosophy about them. People with drive, determination and a clear idea of what they want have pushed and struggled to get their centre open against sometimes almost unsurmountable odds. Inevitably, a certain amount of exposition of the aims and objectives of a centre has been done in order to attract sponsorship, support of relevant authorities etc. This exposition, although not inaccurate, may not represent the complete picture of what a centre is all about (for example, the *educational* aspect may be emphasised when applying to an educational trust for a grant).

This section is divided into two main parts. The first describes what professionals have said they hope to achieve with ISTCs, i.e. their aims and objectives. The second part describes what professionals think actually happens in an ISTC and what they think are the after-effects or impact of a visit.

2.2.1 What professionals hope will happen

Most ISTCs have objectives which are usually a combination of the aims listed below for what an ISTC should try to do, but with varying degrees of emphasis:

- be hands-on
- enable exploration and finding out for one's self
- explain the principles of science & technology
- explain how things work
- be exciting
- be enjoyable
- interest, stimulate, enthuse, etc
- be non-threatening
- make people curious
- increase people's creativity
- change people's view of the world
- be a useful resource for schools

- provide a set of worthwhile and memorable experiences
- be an attraction for visitors
- help in the interpretation of historic objects
- stimulate the development of further ISTCs
- improve the public understanding of science & technology

ISTCs are usually described as catering for one or more of the following kinds of audience:

(a) young children
(b) all children
(c) families
(d) everyone
(e) schools

Some centres stress, for example, the importance of family groups whilst others consider school parties to be most important. Many centres consider that they cater for everybody.

These aims and audiences have been combined in many ways. A few examples of some stated aims of centres around the country now follow.

Gregory (1988) stated that the essential aim of the Exploratory in Bristol was

> .... to introduce children and adults to science as an exciting activity and quest of knowledge.

The Launch Pad sponsorship brochure stated that its aim was

> .... to provide a place where people of all ages can discover that exploring and experimenting in technology can be a satisfying and enjoyable experience.

Patrick Greene (1989) described the decision to establish the hands-on gallery Xperiment! in the Museum of Science and Industry in Manchester as

> .... a desire to equip visitors with an understanding of basic scientific principles that would provide insights into other displays within the museum. It was also recognised that it would need to be effective in its own terms as well, introducing scientific concepts to people who might only visit Xperiment!

The Discovery Dome, a travelling science centre, was described by its originator, Steve Pizzey (1989) as having the intention to

> .... create a centre with its own identity with the aim of stimulating sufficient interest in the regions visited to initiate establishing a small permanent centre locally.

Further afield, in Australia, Michael Gore (1989) stated that the Questacon's philosophy was

> .... to establish a public science laboratory where visitors could experience something of the excitement of experimentation and discovery. To achieve this aim, simple 'props' were provided with which visitors could interact so they could get a feeling for a particular concept. The next stage was to explain the principle and its applications by way of the graphics, text, or by word of mouth via the explainers.

2.2.2 What professionals think actually happens

First and foremost, all ISTCs are *hands-on*; there are no *do not touch* signs and all the exhibits can be touched and played with. There is therefore the general assumption that visitors do interact with the exhibits, and centres are often described as being hives of activity. This activity is seen by some as so great that it leaves little time for reflection or improving understanding.

A common view is that ISTCs are not just places where there is a lot of individual hands-on activity but that there is also a lot of group activity. This is seen by many as beneficial; particularly the interactions between adult and child; the child is seen as encouraging adults to become involved whilst adults can question and provide information when required.

Activity can also include observing. There is a common view that watching other people using exhibits is useful. Not only do visitors learn how to use an exhibit by watching others but gain substantially by doing so. There is a variety of views as to exactly how much observing takes place.

There is a view that children rush from one exhibit to another; that they neither wait for nor seem to welcome explanations. This would seem to support the view that little observation of exhibits on their part occurs.

A commonly held view of ISTCs is that visitors spend very little time reading labels associated with the exhibits, but if a label is read then it is by an adult who then interprets it for their children.

Helpers (pilots/facilitators/interpreters/explainers etc) are seen as a vital part of an ISTC. They mingle with the visitors, answer queries, encourage exploration and generally provide a welcoming and friendly atmosphere. Opinions vary as to how much helpers create an atmosphere in which learning can take place.

It is universally held that a visit to an ISTC should be enjoyable. Views differ as to how much enjoyment there should be in a visit to an ISTC, and a fuzzy distinction is sometimes drawn between enjoyment and fun (or entertainment). This is encapsulated in the view that enjoyment is good, but that *fun* is what you really have in an amusement park and is less good. The implication seems to be that learning does not then take place. However, the leaflet for the Science Centre at Jodrell Bank begins unashamedly:

> Learning science shouldn't be dull or stuffy. At Jodrell Bank we've done our best to make it fun.

The anxieties about "too much fun" were expressed in an article by Michael Shortland (1987) who pointed out that much of science itself was not fun; it was often a

> .... serious, difficult, demanding enterprise which furthermore continually raises political and moral dilemmas.

He acknowledges that science can be fun, and that ISTCs are fun, but questions what it is that visitors are learning or whether they are learning anything at all.

Another view doubts whether the question "Are they learning any science?" is an appropriate one to ask, and suggests that teaching science may not be (or should not be)

one of the primary aims of an ISTC. If the primary aim of an ISTC is to change attitudes (i.e. to make visitors feel that science can be accessible, enjoyable and exciting), then the impact of an ISTC should be measured or judged in terms of the changes in the attitudes of its visitors. This is particularly relevant when visitors may have rejected school science or may have received little or no formal science education. Proponents of this view hold that a visit to an ISTC is often just the first, but an important, stage in the process of learning and understanding science. By showing that science can be enjoyable and accessible in a non-threatening environment it is hoped that learning about science will follow more easily after the visit.

Professionals talk of visitors enjoying exhibits, being puzzled, bored or excited by them. It is assumed that visitors can have as wide a range of affective responses to the exhibits as they can to life itself. There is a generally held view that positive affective responses, such as excitement, enjoyment and interest, are more likely to promote learning than negative responses such as boredom and frustration. It is assumed that the more positive responses and experiences associated with certain exhibits will cause a greater impact, and thus that they will be remembered better than those associated with negative responses.

The views about what visitors actually take away with them after a visit to an ISTC are many and varied. Some of these are summarised below:

- a set of *experiences* (or memories)

  These experiences or memories can be considered to be divided into three categories: what they did; how they felt; what they thought.

- a set of *effects*

  If a visitor notices, for example, that when spinning round on the TURNTABLE a person goes slower when leaning out, then the visitor is considered to have discovered an effect.

- a set of *explanations*

These are explanations for the effects which the visitor has observed. The explanations need not necessarily be correct.

- a set of *applications*

  Some of the effects which a visitor observes may have a practical application. For an ISTC located within a museum, for instance, there may be examples of applications only a short distance away from the exhibit.

- more *understanding*

  Understanding is used in a broad sense, indicating an increased feeling of things making sense.

- a change in *attitudes*

  These are assumed to be attitudes towards science and technology.

Varying degrees of emphasis can be put on the above categories. Some professionals place great emphasis on changing attitudes whilst others place more emphasis on providing explanations and more understanding. It is unclear to what extent professionals believe they are achieving their stated aims.

Frank Oppenheimer (1985), founder and director of the Exploratorium in San Francisco, has written both on the aims of the Exploratorium and, from his own extensive experience, on what actually happens during and after a visit. The following extract is a good example of the kind of mix of views which most people hold:

> We, of course, also think of the Exploratorium in ways other than as a collection of props for teaching mini-curricula. It is a place for sight-seeing, a woodland of natural phenomena through which to wander. Sight-seeing is more pleasurable, it can build the experiences and the intuitions on which other opportunities for learning rely; it can arouse curiosity and, in a broad sense, it can help people determine where they are going and where they will want to make their home. Many of the scientists who visit the Exploratorium have attributed the fact that they are scientists to their early experiences in the Museum of Science and Industry in Chicago. In addition to providing opportunities for sightseeing and for providing a library of teaching props, a museum can, in an overall way make very deep, lasting impressions on its visitors. It can

> re-establish the visitors' confidence in their own ability to understand and to learn. It can give them a sense of roots in the past and it can help them realise that human beings and human acts are a part of nature. More simply, it can engender a comfortable familiarity with aspects of culture that they may have rejected as inaccessible or as undesirable. It is hard to predict or to assess these general effects. One woman told us after being at the Exploratorium she went home and, for the first time in her life, put a plug on a lamp cord. Nothing in the Exploratorium could have instructed her how to do so. She must have felt that since she had made sense of some of the difficult ideas in the museum, she could make sense of other things as well.
>
> Not only should one not expect a visitor to become absorbed in very many exhibits, the atmosphere of the museum must be adjusted in such a way that people are relaxed about missing or not understanding something.
>
> .... most of our exhibits can be used in many ways by the visitors and they are often used in an ingenious fashion that had not occurred to us when building them. When visitors can invent ways to use a exhibit they get a sense of discovery that is much more satisfactory than if they merely discovered what we thought they were supposed to discover. They stay with the exhibit for longer times and usually, but not always, end up by observing the behaviour that we hoped they would when we conceived the exhibit.

From this analysis of views it would appear that there are some general questions which need answering:

1) What kinds of activity, and how much, take place and how do these affect learning?

2) How much thinking takes place during the visit and subsequently?

3) How do visitors react emotionally to the exhibits during their visit and how do they feel about them afterwards?

4) What differences to attitudes does a visit to an ISTC cause in its visitor?

Following a review of the literature these questions will be further refined.

2.3 Literature Review

Many books, articles and papers have been written about museums, and similar organisations, and what happens in them. There have been studies of what visitors do in museums, how they interact with each other and the exhibits, how much they learn and their feelings towards the museum. Staff in museums have evaluated their exhibits in order to increase their effectiveness. Parts of this large literature are relevant to this research. Relatively few research studies have been undertaken and published on ISTCs as they have developed and grown in number only over recent years. Most of the literature is concerned with traditional displays or participatory exhibits rather than interactive exhibits in ISTCs. Much of the early literature was concerned with individual visitors and the effect which the exhibit had on them. It was assumed that it was possible to design an *ideal* exhibit, and that once this had been done then the visitor would learn all that was required from the exhibit. Now it is being increasingly recognised that there are two-way communication processes taking place between a visitor and an exhibit, and also as important, between visitors at an exhibit.

Those people who work in museums, particularly those who devise exhibitions and educational programmes, would like to be able to *predict* what the impact and resulting outcome of a visit to an exhibition or programme might be. Exhibitions are expensive to mount and therefore the ability to predict the educational success of a proposed exhibition would be a considerable help in persuading the museum authorities to proceed and potential sponsors to fund it. The use of formative evaluation as described in Miles, Alt, Gosling, Lewis & Tout (1982) has been used to build exhibits which are more effective, by trialling them with visitors. A study by Griggs & Manning (1983) using mock-ups of exhibits for the Living Cells section of the Human Biology Exhibition at the Natural History Museum showed that valid predictions can be made for the effectiveness of the final exhibits based on the formative evaluation of mock-ups.

Prediction is understandably very difficult, and most studies have been descriptive or evaluative in nature. Visitors come in all shapes and sizes: there are children, parents and

grandparents; foreign tourists, school parties and learned scholars; those who come in to keep out of the rain; and those who come with a specific educational purpose. Therefore there can be no standard average museum visitor. Any predictive theory would have to cope with the wide range of visitors' ages, abilities, backgrounds and attitudes. Falk et al (1985) observed 69 visitors to the Florida State Museum with their permission throughout their stay. Every five seconds a judgement was made as to whether the subject was attending to (a) an exhibit, (b) the setting, (c) own social group, (d) other people, or (e) self. He concluded from his results that although "all visitors were clearly unique their behaviour did not appear to be overwhelmingly idiosyncratic", and that therefore visitors to museums might behave in reasonably predictable patterns. It is very difficult at the moment to envisage being able to *explain* all aspects of visitor behaviour, and so researchers have concentrated on the less ambitious, but possible, task of *describing* visitor behaviour.

Exhibits and exhibitions have always been evaluated for their effectiveness, whether formally or informally (Griggs 1984). The evaluation of exhibits has now acquired sufficient status that there is now a chapter on evaluation in the Manual of Curatorship for museum professionals in the UK. There are several large bibliographies (such as Screven 1984 and Elliott & Loomis 1975) listing many hundreds of papers related to the evaluation of exhibits and visitor behaviour.

Visitors have been observed, with or without their knowledge, as they moved around exhibitions. Records have been kept of the routes they took, which exhibits they looked at and for how long and whether they were observed to read the labels (McManus 1989). Their conversations have been tape-recorded and analysed (McManus 1987, 1988) and their actions video-recorded (Alt 1982). Visitors have been given pre- and post-tests to establish what gains, if any, in knowledge they have as a result of visiting an exhibition. Much of this research has been on how an individual reacts with an exhibit rather than how the members of a group interact with each other. Also, learning has often been considered solely in terms of knowledge gain. This research tells us a lot about what visitors *do* but little about *why* they do what they do.

It is widely recognised that there are fundamental differences between a classroom in a formal education situation and an exhibition in the informal environment of a museum. Lucas (1983) reviewed what was known about learning in informal situations and remarked that studies of school parties were

> .... of little help in understanding how school instruction may help *casual* visitors improve their scientific literacy during museum visits.

He suggested that future research should be aimed at finding out what factors increase the understanding of material in a conceptual framework: e.g. how does an adult's background in science interact with their viewing of an exhibit? The vast majority of visitors (apart from a few coerced to visit by their parents or friends for example) choose of their own free will to visit a museum. However, in the UK and many other countries, children are legally obliged to go to school. Of course in school, children are placed in homogeneous groups according to age and often ability and sometimes sex, whereas visitors in a museum are very heterogeneous. Although museums are generally perceived as educational establishments there is very little competition amongst or evaluation of the learners. In fact, there is cooperation amongst the learners due to the social nature of a museum visit; very few people visit on their own. The freedom of the learner in a museum means that the museum has little control of the learning process, particularly in the presentation of content and its timing.

ISTCs have a big advantage over traditional museums in that they do not usually have to collect, conserve and display *objects* which a museum is normally required to do. A museum has to spend a considerable part of its funding on these core activities. As a consequence the teaching role is not considered to be one of the top priorities; the objects are allowed to speak for themselves. In a science centre without a collection to maintain, more emphasis and attention can be placed on the overt teaching aspect of the interactive exhibits.

In the United States of America, Tressel (1980) argued for increased state funding of science museums and centres on the basis of the important contribution they make in informal science education. It was argued that museum displays and associated

educational programmes reached an audience that was curious and motivated, but which would quickly reject an institution or display that was labelled *education*. This was presented against the background of the challenge of providing effective formal science education.

Over recent years the family group has increasingly been recognised as an important section of a museum's audience. Statistics show that families often form the largest group amongst visitors. At the Science Museum, a survey by Heady (1984) showed that 45% of visitors were part of a family group. And other museums have similar figures. Martin & Mason (1990) of Leisure Consultants reported the results of a survey in Great Britain which showed that one in four adults visited a museum at least once a year. Looking ahead to the year 2000, Lewis (1990) of the Henley Centre for Forecasting predicted that between the years 1989 and 1995 the number of people in the family formation group (25 to 34 year olds) would rise by over 7%, thus providing museums with an opportunity to expand their audiences by looking to family groups. It is interesting to note that during the period 1988 to 2000 the number of 16 to 24 year olds will fall by over 20%, while the 45 to 59 year olds will increase by 17%. If museums were to respond just to these demographic changes then they would look to cater more for family audiences.

As the importance and usefulness of informal education becomes more widely recognised then the value of the family in teaching and facilitating learning for its members has been promoted more. It is surely not insignificant that a book was recently published with the title "Museum visits and activities for family life enrichment" (Butler & Sussman 1989). It contains a series of articles from various perspectives such as sociology, education, museum research and family therapy which look at the background, issues and understanding of family learning. Only one article (Hilke 1989) presents any new research data, whilst another (Hood 1989) reviews three earlier visitor surveys.

The ideal family group is often thought to consist of a man and a woman living together with their off-spring. In the past the man was considered to be the breadwinner and the woman the one who looked after the home. The ideal, or nuclear, family now represents

about 9% of all households in the US. There are many other kinds of family groups. One-parent families now account for 21% of all households in the US. It has been seriously argued that museums and similar institutions now form essential places to visit when the parent separated from their children takes them out on their access days. Therefore, family groups in all their different variety of forms are being increasingly recognised by museums as an important audience and suitable programmes are being provided. For example. at the Science Museum the special demonstration lectures at Christmas and Easter were devised and advertised as being *suitable for children aged 8-12 and their families.*

The structure of a family group has moved from being a rigid one, where each individual had a specific role to play, to a flexible one where many of the functions are shared between family members by common consent. The sociological perspective of the family, and the role that museums play in the educational and socialisation processes of the family, were explored by Wolins (1989). This paper quoted family sociologist Sussman (1974) as having defined the main tasks of the family to be:

- developing capabilities to socialise children
- to enhance the competence of their members to cope with demands of the organisations in which they must function
- utilising these organisations
- providing an environment for the development of identities and affectional response, and
- creating satisfactions and a mentally healthy environment intrinsic to the well-being of the family.

Whereas in early and primitive societies, children learned by watching and doing, in modern society schools and other formal organisations are necessary to transfer more specialised skills and knowledge. Unfortunately some people assume that *education* is the complete responsibility of the schools with the social aspects left to the responsibility of the family. This change in emphasis has not lessened the importance of the family as studies (e.g. Lavin 1973) have shown that families can affect the academic performance

of their children.

Research on family behaviour in museums has highlighted the fact that families do behave as a social group throughout their visit, and therefore should be treated as a group and not as a set of individuals. Details of a few studies now follow which have a particular relevance to this research.

Some base-line information on what family groups do during a museum visit was provided by the study of Diamond (1986). The technique, ethological observation, was used to systematically record the behaviour of family groups and to quantitatively analyse the behavioural frequencies. A total of 28 groups were observed for the duration of their museum visits: half of these were visitors to the Exploratorium, San Francisco and the others were visitors to the Lawrence Hall of Science, Berkeley - both institutions contain large numbers of interactive exhibits. A single adult-child dyad was chosen, with their consent, from each group as the focus of the observations. The observer recorded:

- the speech and actions of the focal dyad, as well as all significant behaviour directed toward the focal dyad by other individuals
- the temporal relationships between behaviours, both within and between individuals
- objects, exhibits, or other environmental stimuli that influenced the subjects
- all interactions of the subjects with the observer.

At the end of a group's visit the observer conducted a brief interview with them to find out the children's ages, a general idea of the subject's science and museum experience, and the relationship between the group members, and names and addresses. The frequencies were tabulated with respect to social role (father, mother, son, daughter) and were compared in a series of one-way analyses of variance. When significant effects were found, Student-Newman-Keuls post-hoc comparisons were used to isolate the source of the differences. Behaviour frequencies were also analysed with respect to each consecutive quarter of the museum visit, defined as 25% of the exhibits visited.

It was reported that the average science museum visit lasted slightly over two hours. An average of 80% of the time in an LHS visit and 92% in an Exploratorium visit was spent in the exhibit areas of the museums. An overall mean of 62 exhibits was visited (S.D.=30). Subjects appeared to *shop around* as many exhibits were visited for very brief periods of time; 57% of the exhibit visits lasted less than one minute and 18% of the visits lasted for three minutes or more. The most common behaviours displayed by family members in the science museum involved approaching an exhibit, manipulating it or observing someone else manipulating it, and then withdrawing. Observing other people at exhibits occurred as often as manipulating the exhibits (each occurred at 40% of the exhibits. Children engaged in a significantly greater frequency of manipulating exhibits by themselves than did parents. Manipulating exhibits together occurred at an average of 13% of the exhibits visited. It was also found that the tendency to engage in any form of social behaviour, reading and verbal descriptions of exhibits declined significantly throughout the visit.

Diamond (1986) also observed behaviours which demonstrated teaching: *show* and *tell* occurred at 13% and 9% of the exhibits respectively. Parents appeared to make use of the exhibit graphics for teaching or learning purposes, especially to supplement their own knowledge of the exhibit; overall, the graphics were read at 11% of the exhibits visited, although adults read the graphics significantly more often than did their children (reading aloud occurred at 6% of the exhibits). Diamond (1986) concluded from these results that

> .... learning in a science museum does not occur only or perhaps even primarily as a result of the interaction between individual visitors and the exhibits. There is substantial evidence that social interactions between visitors may be important in stimulating learning at exhibits.

It was felt that teaching was a fundamental aspect of the spontaneous interactions of family members, and that teaching not only provided information about the exhibits, but also influences the attitudes of people as they interacted with and ultimately learned form the objects and phenomena. It was suggested that in order to observe some significant learning experiences in museums, it was necessary to study visitors throughout their entire visit.

Hilke (1989) observed 42 family groups consisting of 128 individuals (of which 98 were directly observed) at a large metropolitan museum of natural history in North America. Approximately half of the individuals were observed in a traditional part of the museum (with railings, cases etc) and the others were observed in an enclosed participatory hall (with interactive exhibits and hands-on displays). The permission of the group was sought to observe them. Individuals were observed successively for approximately 8 minutes each and then another member of the same group was observed. All actions of the subject under observation were recorded including those actions involving other members of their group. The subject's behaviour was coded in a form that recorded the particular action undertaken (action-event), along with the initiator of the action (agent), the topic or direct object of the action (content), and the recipient of the action (social context). The length of times for which activities took place were not recorded.

Hilke's data revealed that the exhibits, rather than strangers or the museum surroundings for example, were for all family members the main focus of attention; 86% of all events undertaken were concerned with the exhibits. The entire set of 98 codable action-events was subdivided into five mutually exclusive categories:

- pure-info (gaze at, manipulate, ask for information)
- experiential (included personal reaction: "I like that one")
- interactive (altering behaviour of others e.g. tell to do)
- transitional (moving from place to place e.g. go to, follow)
- other (e.g. wait, eat, don't know)

It was assumed that those behaviours concerned with acquiring or exchanging information (i.e. pure-info) were most likely to be learning related. As 66% of all action-events were in the pure-info category it was concluded that family members were not only attending to exhibits but were also pursuing a clear agenda to learn while the museum. Further analysis of the data revealed that 90% of all pure-info behaviour and nearly 92% of all experiential behaviours focused on the exhibits themselves, whereas only 74% of transition behaviours and 36% of other behaviours were specifically exhibit related. The data suggested that individuals attempted to acquire information first-hand from the

exhibits;

> Family members invested more than 82% of their personal strategies for acquiring information in manipulating, touching or looking at the exhibits. Less than 18% of their personal strategies sought ready-made interpretations from the labels or diagrams bedecking most exhibits.

The data did not show that parents were overtly teaching their children (i.e. parents were not observed to give lengthy explanations), or that children were asking more questions and that the adults were more responsive. Children frequently chose the exhibits which interested them and parents did not try to constrain their behaviour. Hilke concluded that

> .... if parents pursued an agenda to teach their children, they did so with such subtlety that the spontaneous pursuit of individual agendas to learn and share was not visibly disrupted. Whether examined overall or in detail, family learning in the museum was always characterised by a dynamic interaction of the behaviour of *all* participants.

Overall there were few substantial differences in the data between the traditional exhibit hall and participatory room. As expected there was more direct manipulation of the exhibits in the participatory room. In the traditional hall, where they could not handle the exhibits, family members relied on one another for explanations, descriptions and other interpretative comments about the exhibits.

Hood (1989) summarised three studies which investigated why people do or do not choose to visit museums and what criteria they use in making their leisure activity choices. Subjects were queried on their feelings about six attributes: having the opportunities in leisure time to be with people (social interaction), to do something worthwhile, to feel comfortable and at ease in one's surroundings, to have a challenge of new experiences, to learn, and to participate actively in leisure events. Of these attributes the one most consistently preferred by all sub-groups was *having a challenge of new experiences*, particularly by those groups with children. Parents of children aged 6 to 11 comprised the group least interested in *learning*, preferring to focus on *social interaction*, *active participation*, and entertainment values. The group most interested in leisure time learning was adults without children. Occasional visitors, who were often more family-centred, perceived museums to be

> .... passive, spectator settings where they could expect little satisfaction. Far more

> **interested in active participation during leisure time, they found the museum's emphasis on educational opportunities to be a hurdle, not an asset.**

These occasional visitors, often less-educated than others, saw museums as rather forbidding places where they did not understand the museum code of objects and labels. It was found that the complete museum visit was important to a family group; families expected and valued high levels of comfort (toilets and baby-changing areas, seats, lifts, refreshment facilities etc) while participating in leisure activities - levels they rarely found in museums.

A paper by Beer (1987) compared the behaviour of museum visitors with the beliefs of museum staff about that behaviour. The study was carried out in ten small museums of art, history and science in the Los Angeles area. During 160 hours of observation, the behaviour of 1686 visitors was recorded. No details of the behavioural categories were given. Twelve members of the museum staff were interviewed two years after the observations had been completed. Observations and interviews were structured around five variables:

- *goals* for the museum visit
- *time* spent at displays
- exhibit *materials*
- use of the exhibit *space*
- *evaluation* of displays

The major findings reported were as follows:

(a) Museum staff consistently overestimate the time that visitors spend at displays (only 36% of museum displays were attended to by visitors for more than 30 seconds, almost half (43%) were skipped entirely).

(b) The time that visitors spend at a display varies with the materials used to construct it; they attended more frequently to displays that contained combinations of materials.

(c) The expectation of museum staff that visitors will avoid reading labels is realistic as visitors had a propensity for engaging in any activity other than

reading; they were most likely to touch or manipulate objects and least likely to read text or directions.

(d) A display of *manipulable* objects alone will not increase visitor interaction; manipulable-only displays were skipped 63% of the time, almost as often as text-only displays (68%).

(e) Patterns of visitor traffic are the result of more than just the spatial arrangement of the displays. Findings of previous investigations (e.g. Melton 1933 and Robinson 1931) that visitors attend more often to displays that are to the right and near the entrance was not supported by this study.

(f) Both staff and visitors have a range of goals for the museum experience. Summarising, 53% of visitors came to gain factual knowledge, 22% for factual knowledge of child or guest, 14% to fill in time, and 11% because of the weather. These stated goals did not however have much impact on their behaviour. Although staff expected visitors to acquire factual knowledge, other goals such as to appreciate objects and have a good time, were often more important to them.

(g) Evaluation of the displays or the knowledge gained from them was unimportant to both staff and visitors.

As has already been noted, there has been little research on *how* visitors learn from interactive exhibits in an ISTC. Some studies have shown *what* visitors learn. The problems of conducting this kind of research in informal settings are considerable and well known (see for example, Lucas, McManus & Thomas 1986).

Observation can give information about what people did; how they interacted with an exhibit, whether they looked at it, ignored it, read the label, talked to friends or a relative etc. Conversations can be tape-recorded, transcribed and analysed at a later time. Video recording can also be used, although this does generate a lot of data which can be difficult to handle. It is generally recognised that the subject should be observed in relation to their group as there are many social interactions taking place during a visit. It is difficult to observe all that is taking place as the setting is informal and other visitors can easily

get in the way and there is a heavy burden on the observer to code all that is taking place. If the observer has obtained the permission of the subject to observe then this may change the setting and alter the subject's behaviour.

Interviewing visitors after their visit clearly places reliance on the subject's ability to recall accurately how they interacted with the exhibit, but may not reveal their unconscious thoughts or actions. A basic assumption with this kind of research is that it is possible to infer from the subjects' behaviours some aspects of the learning processes through which the subject is going. Similar assumptions are made when investigating learning in the laboratory or in the classroom. As an ISTC is an informal setting emphasis should be given to preserving its informal nature and not turn it into a research laboratory. Therefore unobtrusive methods of observation should be preferred, as well as interviews which ask the subject to reconstruct their experience once it is finished.

Lucas et al (1986) tape-recorded visitors' conversations at two exhibits in the Natural History Museum; one was an interactive game exhibit in the Origin of Species exhibition, and the other was a more traditional glass case in the insect gallery. There were gaps in the transcripts due to physical difficulties in making recordings in conditions which were far from ideal. Also, no information about the subjects' physical interactions with the exhibits was collected. Their analysis of the conversations suggests that labels are important, as subjects referred to them in their conversations (no quantitative analysis was presented). The labels had a role in telling the visitor how to play the game and in providing information. There were instances of the label prompting recall of information that the subject already knew. Some visitors were observed to return to the game exhibit to check or modify their understanding after viewing another part of the exhibition. The authors conclude that their methods reveal different aspects of the learning experiences of children, and that attention should be given to considering the social interactions between visitors when investigating learning from interactive exhibits. Also they suggest that

> .... we should not focus only on the intended purpose of an exhibit, but need to be alert to unintended exploratory behaviour, which may be as *scientific* as the planned possibilities.

In a study of visitor behaviour at the Natural History Museum, McManus (1987) recorded the conversations, and made unobtrusive behavioural observations, of 1572 individuals in 641 groups at two traditional static displays and three interactive displays. Eleven types of group were defined including those with children, singletons, couples and adults only. It was found that 78.3% of the groups played with the interactive exhibits in some way, and that 12.5% of groups had someone who fully attended to the labels although 39.1% of groups did have someone who glanced briefly at the labels (therefore 48.4% of the groups were not observed to read any text). The mean time of an exhibit visit was 73 seconds (SD=65) and the mean length of conversations was 53 seconds (SD=47).

The groups containing children were found to interact with the exhibits more, to have longer conversations, read less and stay longer than other groups. In comparison, groups consisting of couples read with attention and spent long periods of time at the exhibits, although they did not talk or interact with the exhibits as much as other groups. Those going around by themselves read the labels carefully but did not interact with the exhibits very much. It was concluded that visitors

> .... bring with them, as part of the social context of their visit, the propensity for variation in behaviour related to interaction with the exhibit.

Further elements of this study were reported in a following paper (McManus 1988). It was argued that a friendly group which got on well together might learn more than a less intimate group. In order to investigate this each group's *cohesion* was marked as poor (members more than 1m apart), good (moving closely together) or very good (shoulder to shoulder or touching). It was found that 82.5% of visitors had behaviours in the good and very good categories. The findings suggested that cohesion was a specific property of the group and was independent of gallery crowding for example. Groups showing very good cohesive behaviour were more likely to show comprehensive reading behaviour. Not unexpectedly, groups with good cohesion talked more together.

Discourse analysis was used to analyse visitors conversations to see how individuals got things done in a social context. It was concluded that there were differences in the way that individual visitors dealt with information from exhibits, and that there were

differences between groups, such as family and adult peer groups, for example. These differences could not have been detected just by observing the visitors at the exhibits.

By its very nature, the development of ISTCs requires that the exhibits are evaluated in order to make sure they are effective and have *visitor appeal.* Most of the exhibit development takes place informally through a process of trial-and-error and using the acquired experience of exhibit fabricators. Formative evaluation is often carried out informally by getting museum visitors *off the floor* to try some exhibits under development and see what happens. A few studies, for example Harlen et al (1986) and Russell et al (1987), have been commissioned by ISTCs from outside evaluators and the reports made public. These kinds of evaluations are often commissioned for many reasons, not just for the sake of developing good exhibits. For example, it may be important for an aspiring ISTC that an independent survey shows that the centre has a high visitor appeal and educational value.

In the evaluation of Technology Testbed at the Merseyside Museum's (as it then was) Large Objects Store, visitors - mainly children in organised school parties -were tracked and then interviewed at the end of their visits. A stand-alone microcomputer program provided some information on visitors' reasons for coming to Technology Testbed which showed that curiosity was high on most peoples' list of reasons. 48% of visitors said that they spent more than one hour in the centre. Tracking a visitor consisted of noting which specified actions (such as reads label, touches apparatus, talks with another, etc) took place at each exhibit. The total time spent at each exhibit was recorded, but not how long each action lasted. 201 visitors were tracked, without their knowledge, whilst circulating around the 23 exhibits in the centre. The data provided clear evidence that visitors do interact with the exhibits: the average incidence of visitors touching the exhibits was 90%, of which 42% of contacts were by visitors acting alone. They also found time to watch others (44%). Most visitors (67%) needed no encouragement to interact with the exhibits. In 23% of the exhibit contacts, label reading was observed. It was also noted that visitors would return to exhibits and queue for the popular ones. There were exhibits which were clear favourites with the visitors and the most popular reason offered for it being their

favourite was that it was enjoyable or fun to do. Eighteen per cent of visitors referred to their favourite exhibit as one at which they had learned something or been made to think.

Studies concerning visitors' recollections of their museum visits will be reviewed in Chapter 3 following a discussion of the relevance of memory studies to this investigation.

2.4 Conclusions

The evidence accumulated from a wide range of studies so far indicates that

(a) families do want to visit museums, particularly those with good *customer care*, mainly for reasons of it being a *good day out*,

(b) it is a very social occasion with the members of the family acting equally with one another,

(c) they spend quite large amounts of time looking at and interacting with the displays and exhibits,

(d) some learning does take place.

Learning in museums has been measured by giving visitors immediately after their visit tests of knowledge. This assumes a model of education which is often found in schools and that it is possible to measure the *outcomes* of a piece of teaching. The often complex measurement techniques can only measure the outcomes, they give little indication of how they came about or how they will be used in the future i.e. the *processes* through which learning takes place are not explored. We know that visitors talk about the exhibits whilst they are in front of them, and it is possible to suppose that they talk about them afterwards; perhaps on the way home or several weeks later. Also, the museum visit is only a part of their total experiences; how do they relate the visit to what they already know, their experiences in school or at work, television and radio programmes, newspapers, etc? Questioning visitors immediately after their visit can only give a part picture.

This thesis attempts to investigate in more detail the outcomes of a museum visit by conducting a study of visitors in order to find out whether they process any information acquired during their visit at a later stage. Therefore visitors have been interviewed not only immediately after their visit but also six months later. Full details of the methodology used are given in Chapter 4.

Since a large part of the data collection involves visitors recalling what happened many months ago then it is important to have an appreciation of current understanding of how memory itself works. Chapter 3 is therefore devoted to learning and memory.

At the end of section 2.2 on Professional Views, four general questions were raised concerning the behavioural, cognitive, affective and attitudinal aspects of a museum visit. In the light of the literature review and of other issues which have been raised it is now possible to refine these questions as ones which this research might address. As the data was collected in Launch Pad, the interactive gallery of the Science Museum, and it was decided to concentrate on family groups, so the following questions reflect those decisions.

1. Behavioural: What do family groups do in Launch Pad?
    (a) Do visitors spend significant amounts of time looking at and interacting with exhibits?
    (b) How much attention do they pay to their surroundings?
    (c) Is their behaviour different at different exhibits?
    (d) What differences in behaviour are there by age and sex?
    (e) How much social activity takes place?
    (f) Does the group's behaviour change over time?
    (g) Are there characteristics of exhibits which, for example, make them popular or unpopular?

2. Cognitive: What do they think about Launch Pad? And for how long? (Do they think at all?)

(a) During their visit do they think about what the exhibits are all about?

(b) Do they remember the exhibits?

(c) Do they try to explain the exhibits?

(d) Do they relate the exhibits to what they already know?

(e) Do they think about it afterwards?

(f) How much do they learn?

3. Affective: How do family groups react emotionally to their visit?

(a) What emotional responses do visitors have to the exhibits?

(b) Do these responses vary from exhibit to exhibit?

(c) What responses do visitors have to Launch Pad as a whole?

(d) Do they find it an inspiring experience?

(e) Do their reactions change over a long time?

4. Attitudinal: What differences to attitudes result from a family's visit to Launch Pad?

(a) Are they more "turned on" to science and technology?

(b) Do they follow up any of the interesting things or effects they may have seen?

Finding answers to these questions involves talking to visitors over a period of time. From their answers it should be possible to ascertain whether the professional's views on what they expect might happen are realistic. Do visitors take away with them sets of:

(a) experiences

(b) effects

(c) explanations

(d) applications

(e) understandings?

CHAPTER 3 MEMORY

This chapter considers the role of museums and visitors' expectations of them. As they are generally thought of as memorable places, theories of memory are discussed. For the sake of simplicity, the word *museum* is used to cover interactive technology and science centres as well as science museums.

3.1 Museums and People

Why do people visit museums? Museums are full of objects, and an obvious answer is to say that people come to museums to see what is in them i.e. the objects. It has been said that museums are glorious depositories of a nation's heritage to which visitors can come in wonder and awe. Prince (1985) found that, in a survey of visitors and non-visitors, over 90% of those interviewed held this image of a museum.

Museums themselves strongly believe that one of their primary roles (if not *the* primary role) is to look after the objects. The definition of a museum adopted by the Museums Association in 1984 is

> A museum is an institution which collects, documents, preserves, exhibits and interprets material evidence and associated information for the public benefit.

It is possible, for example, to visit the Science Museum in London in order to look at some of the first steam locomotives such as Stephenson's Rocket; the Apollo 10 spacecraft which carried three astronauts around the moon in 1969; and equipment used by famous scientists such as Newton, Kelvin, Faraday, Crookes and Pasteur. One *has* to come to the Science Museum in order to see the *real thing*, seeing the same thing in a book, or on television, is no comparison. Dr Neil Cossons, Director of the Science Museum, boasted in the forward of one of its guides that the Science Museum is:

> .... a unique institution. Its collections record an event of outstanding importance in human history, the emergence of the first industrial society made possible by

> the blossoming of science and technology. No other museum in its field offers collections so rich or diverse nor such a wealth of material evidence fundamental to an understanding of the modern world. Those of us whose privilege it is to look after these collections try to share with our many visitors the insight and enjoyment that comes from daily contact with three-dimensional history.

As the above quote suggests, museums also have an educational role of sharing knowledge and experience. Some museums have taken this educational role very seriously. For example, the Natural History Museum adopted a new exhibitions policy based on didactic displays over ten years ago. More traditional museums have however continued to emphasise the primacy of their collections, arguing that if they did not collect and conserve then they would not have any artefacts to display when it became possible to do so.

Dr Cossons also suggests that a museum visit should be enjoyable. How do museum visitors themselves view a visit: do they come to learn or to enjoy themselves? Market research strongly suggests that people visit museums for enjoyment - it's a day out. Borun (1977) found that 39% of visitors to the Franklin Institute in the United States come for fun; 21% to entertain the children; 15% to do something with the whole family; and only 25% come to learn something about science. Heady (1984) found that 45% of visitors to the Science Museum came in family groups and a further 20% came with friends. In the same survey, Heady also posed the question "When you have been round a museum is it important to you to feel that you learnt something or do you just enjoy looking at things?". Forty five per cent of family groups and 61% of other groups thought that learning was important whilst 67% of those visiting alone thought it was. The question is phrased somewhat unfortunately as it suggests that just looking is not as good a response as learning something. So the figures just given may be a little high. Clearly a museum visit is a social occasion; an opportunity for a group to go out together, to interact with one another and to gain something from the experience.

Over recent years, with reduced government funding in real terms, many museums have realised that they are competing in the leisure market and have therefore improved their standards of customer care and their marketing. Visitors now expect a high standard of

service (shops, toilets, cafeteria, baby changing rooms etc) and are more willing to pay the market rate for their day out.

3.2 Museums are Memorable

Museums are generally thought of as being memorable places - people not only remember the visit as a special event but also remember much of what they saw and did. As mentioned in the previous section, the primary role of a museum is to collect, conserve and display material of historical significance, thus its purpose could also be said to be to keep certain memories alive in people's minds. Research on visitor behaviour in museums has indicated that visitors only spend a minute or two in front of each exhibit and that after about 30 to 45 minutes *museum fatigue* sets in. This suggests something of a paradox. Why do visitors find a museum visit memorable considering the short time during which they are involved with the museum and its exhibits? Research on visitor behaviour has not indicated that visitors are showing a great degree of surprise, or other behavioural signs which might make an experience particularly memorable.

In Stevenson (1987b) - see Appendix C - I argued that a knowledge of how memory works (as it is currently understood) and an analysis of visitors' memories of a visit may provide insights into understanding the impact that ISTCs have on their visitors.

Considering that a visitor on average spends so little time with each exhibit then it seems unlikely that much cognitive processing will take place. If this is so then we should expect that most visitors' memories of their experiences would be episodic rather than semantic (a distinction first made by Tulving 1972). Episodic memories consist of autobiographical information about events in one's own life, whereas semantic memory results from some kind of cognitive processing and consists of facts about the world in general.

The memory of a person's first visit to a museum is usually primarily episodic, especially

if they have not encountered the idea of a museum through reading, TV etc. After several visits to different museums a person will form a general idea of museums as places where there are objects of historical significance, staff to look after them, etc. This generalised knowledge or *schema* - an idea introduced by Bartlett (1932) - contains information about a given event or a subject which we have accumulated through our experiences. Our schemas are used to interpret the flow of information from our senses. When we walk into a particular building we might recognise it as a traditional museum, and therefore our traditional museum schema is used and we know what to expect. We expect to see rather severe security guards in dark uniforms, an admissions desk and other visitors; there will be artefacts in cases with learned labels and so on. Our schemas also tell us how to behave; for example, in a traditional museum one is not allowed to touch the artefacts. Fortunately, with recent improvements in museums most visitors would now bring in to use their modern museum schema in which they expect to be given a friendly welcome amongst many other improvements. With the growth of the hands-on movement, some visitors now have a *hands-on centre* schema. From this they expect to be able to touch, handle and take to pieces most of what they will see. These schemas may be linked together, probably under a *general museum* schema which may itself be part of a *trips-out* schema.

As mentioned above, schemas are used to interpret and store information coming from our senses. Therefore memories are not straight-forward copies of our experiences. Schemas are used to select what is encoded and provide a framework under which the new information can be stored. Our use of schemas tends to generalise particular experiences and specific details may be lost. For example, we may remember paying to come into the Science Museum but may not remember what the admissions desk looked like or what the charge was. As specific research studies mentioned in section 3.3 will show, people may think they remember what they expected to see according to their schema rather than what they actually saw.

A script is a particular kind of schema which consists of a sequence of actions which takes place in a familiar situation such as eating in a restaurant, going to the doctor, or

visiting a museum. This idea was developed by Schank (1982) who was working in artificial intelligence and trying to get computers to understand text. A restaurant script, for example, might contain the following main elements: entering, ordering, eating and leaving. Each of these would contain further information on how to order food for example. Possession of a restaurant script enables us to know what to do when we enter a restaurant. Similarly, most people know what to do when they enter a museum. Coming across Launch Pad in the Science Museum may for many people have meant modifying their museum script; museums *can* contain areas in which you *are* allowed to touch.

As just described, a script can change and Schank has developed the idea of scripts into a dynamic memory model which includes higher levels (i.e. more general) scripts termed MOPs (memory organisation packets) and TOPs (thematic organisation points). Also, unusual instances of a generalised event are tagged so that the memory can be recalled by being reminded, for example "Do you remember that time we were in a museum when we were stopped and interviewed?". Scripts, although developed for computer systems and still in an early stage of development, do seem to provide a reasonable model for how people remember an event in their life. For the subjects involved in this thesis the event was a visit to Launch Pad.

Schema theory, however, is not very good at explaining why certain events can be remembered in vivid detail. The *levels of processing* approach can help to explain this aspect. Craik & Lockhart (1972) argued that perception, attention and memory are interdependent. Therefore, the more processing that takes place at the time of encoding the memory trace, the better the memory of the event. Deep, distinctive or elaborate processing can also affect long-term memory. It is not just the processing which takes place at the time of encoding which may be important. Memory seems to be reconstructive, or constructive, and therefore processing can take place after the initial encoding.

The dynamic and constructive nature of memory was expressed by Bartlett (1932) in the

following way:

> Remembering is not the re-excitation of innumerable fixed lifeless and fragmentary traces. It is an imaginative reconstruction, or construction, built out of the relation of our attitude towards a whole active mass of organised past reactions or experience, and to a little outstanding detail which commonly appears in image or language form.

Piaget & Inhelder (1979) were interested in how people acquire schemas and expressed the changing nature of memories as follows:

> We reorganise our memories and ideas of the past, conserving more or less the same material, but adding other elements capable of changing its significance and, above all, of changing our viewpoint.

It is not clear how constructive memory really is and memory researchers are continually updating or modifying their positions. As Neisser (1988a) said:

> A great many issues in the study of memory - ecological or traditional - are presently open; that is why this is a good time to reconsider them.

In the next section, some research studies which may have relevance to the work in this thesis are reviewed.

3.3 Everyday Memory

In 1976, Neisser (1978) crystallised the views of many psychologists who had doubts about the emphasis given to formal laboratory experiments by describing the work of the past 100 years as largely worthless. He claimed that the traditional experiments shed little light on the most interesting and significant questions relating to memory in the real world. How do we recognise faces and remember names? Why do we remember some events vividly and forget others? How do we know that we know something but cannot immediately recall it; the *tip-of-the-tongue* experience?

Neisser strongly advocated investigating everyday aspects of memory in the real world, and the need for *ecological validity* i.e. the research should apply to naturally occurring behaviour in the real world, and not to unreal situations artificially created in the

laboratory. The resulting wave of interest in everyday aspects of cognitive psychology was not just confined to the study of memory. Although a visit to Launch Pad may not be an everyday occurrence, the recall of events, and associated feelings and thoughts, is most closely associated with the research carried out on everyday memory rather than with closely defined laboratory experiments.

Researchers into everyday memory have explored many of its aspects: people's abilities to remember names and places; memory for places - knowing where we are, and how to get from A to B; minor memory lapses or tip-of-the-tongue experiences; remembering to do things; absent-mindedness; to name just a few. For a review of these kinds of phenomena see Cohen (1989). In this chapter, I shall review the research and summarise the findings for those aspects which seem most likely to be relevant to the research carried out in this thesis (particularly that of the Follow-Up Interviews). These aspects are memory for places, memory for objects, memory for events (eyewitness testimony) and memory for personal experiences (autobiographical memory). As many people's recall of their Launch Pad visit is vivid and detailed, a discussion of *flashbulb memory* is also given.

Throughout each day our senses are bombarding our brains with information. Our brain is fortunately highly selective; for example, we do not remember the face of every person we pass in the street, or each conversation we have, word for word, or everything we read. Therefore it is important to try to identify those factors which influence this selection process.

3.3.1 Memory for places

Research has been carried out into how people find their way about their own home, within cities and across country, and individual differences in navigational ability have been assessed. However, the most relevant research in this area is concerned with subjects' ability to remember the location of objects in a room.

Brewer and Treyens (1981) called subjects one at a time from a room where they had

been asked to wait alone for 35 seconds. They were then given the unexpected task of recalling as many items as they could from the room, which had been set up as an office. Some objects in the room (such as a desk and typewriter) were ones that are normally expected in an office. Others (such as a rolling pin and a skull) were unexpected. A different set of subjects rated how likely it would be for an object to appear in a room of this kind, and also rated how noticeable an object was. An analysis of the results of this experiment showed that subjects remembered best those objects that were most likely to be present rather than those which were atypical. Also, objects that were not there, such as a telephone, but which are likely to be in an office were falsely recalled, Also, subjects remembered expected positions rather than their actual positions. An example of this was a notepad which was incorrectly remembered as having been on the desk rather than on a chair.

These results can be explained by schema theory. People have a schema of an office and therefore objects that are consistent with the office schema are remembered better than those which do not fit. Also, subjects' schemas led them falsely to remember expected objects and to remember objects in their expected positions. However, objects which were very noticeable were more likely to be recalled particularly if they were bizarre or surprising in that context (such as the skull).

Mandler and Parker (1976) also found that the remembered positions of objects in a room were influenced by subjects' expectations of where things ought to be. Most of these results can be adequately explained by schema theory.

3.3.2 Memory for objects

Everywhere we look there are objects which we automatically recognise, can usually name and about which we can provide further information if desired. Our memories are such that we can tell the difference between a dog and a cat without thinking. This largely unconscious process of recognising objects is developed from when we are born by exploring our environment and learning from it. We also need to remember where objects are; it is often annoying when failures occur such as mislaying our car keys. The

recognition of objects will not be discussed but the lapses of memory concerned with forgetting where objects have been placed will be discussed, as the processes involved in searching for lost objects may have relevance when visitors are trying to recall events which happened during their visit to Launch Pad.

When we forget where an object has been placed one of the following errors may have occurred. First, we may have put the object in an odd or unintended location and forgotten where. Second, we may have put the object in one of several familiar locations but forgotten which. Third, we may actually have remembered the correct location of the object but failed to find it when we looked for it.

Tenney (1984) gave a questionnaire to some young and elderly subjects asking them to report any incidents of losing objects over a two week period. They were also asked to rate themselves on a scale of absent-mindedness. The expected age difference did not materialise as the 30% of subjects who recalled such an incident were divided equally between young and old. Also, there were no age differences in the self-ratings of absent-mindedness. However, those subjects who rated themselves as absent-minded did lose more objects than those who did not. In 62% of incidents the objects were left in unintended places and the subjects could not remember having put the object in these places in 58% of these cases. It would appear that many of these incidents consisted of losing common objects in familiar situations. This would suggest that since many routine activities are under automatic control (i.e. little conscious monitoring) the action of misplacing the object is not adequately encoded and is therefore forgotten.

The ability to forget is an important aspect of everyday life. We need to remember where we put our glasses or parked the car the last time we did it, rather than the time we parked the car last week. Bjork (1978) proposed two mechanisms of updating this kind of information: destructive updating where memory for previous incidents is completely erased, and structural updating where memory of earlier incidents is retained but ordered chronologically. In Bjork's experiments, which consisted of remembering pairs of words, subjects were given instructions based on destructive and structural strategies. In each

trial the stimulus word remained the same but the response word varied. Subjects were asked to recall all the response words as well as the most recent response word. Subjects found that they were unable to carry out the destructive strategy of mentally erasing the old word on a blackboard and writing in the new one. Subjects given a story line to link the response words together in the structural strategy recalled more words, although total recall was poor. These findings fit with our everyday experience; it is difficult to deliberately forget something, presumably because the cognitive process in trying to forget actually makes it memorable.

3.3.3 Memory for events (eyewitness testimony)

In courts of law great relevance is placed on eyewitness testimony, and if we say that *we saw it with our own eyes* then we mean that we really believe it to be true. However, faith in the accuracy of what we recall from watching an event may be a little misplaced.

In a similar result to Brewer and Treyens' experiment (see page 58), List (1986) found that her subjects, who watched a video showing eight different acts of shop-lifting, remembered more high probability elements than low ones (elements in the video sequences were separately rated as high or low probability in a shop-lifting event). Also, they falsely remembered events which had not taken place but which had a high probability.

A number of experiments have been carried out to show the effect misleading information or leading questions have on subjects' ability to recall accurately events they have witnessed.

Loftus (1975) showed two groups of subjects a film of a car accident. Later both groups were asked questions which also contained information about the accident; for the control group the information was consistent (or accurate) whilst the misled group received information which was misleading (or inaccurate). For example, the mislead group were asked *How fast was the white sports car going when it passed the barn while travelling along the road?*, and the control group were asked *How fast was the white sports car*

going when it passed the stop sign?. In the film there was no barn but there was a stop sign. Later, when subjects were questioned about the film, 17% of the misled subjects reported seeing a barn whilst only 3% of the control group did so.

It has also been shown that subtle changes to the wording of questions can affect the responses of a witness. In one experiment, Loftus (1974), the question *Did you see the broken headlight?* elicited more positive responses than *Did you see a broken headlight?*. If the information given is blatantly incorrect then witnesses are much less likely to be misled.

If witnesses make a public statement of what they have seen then they are less likely to be influenced by misleading information or questioning at a later stage. It has also been found that misleading information has more of an effect if it is given when the memory of an event has had a chance to fade i.e. after about a week.

Researchers are not in agreement on the explanations for these effects. Also, the fate of the original memory is in dispute. Some believe that the false memory has replaced or transformed the original memory which is then irretrievably lost. There are also views that the two memories co-exist but that one is more accessible than the other.

Whatever the explanations it is clear that recall of events may be inaccurate, and that the way in which subjects are questioned about their memories can affect what they recall. Subjects will also tend to recall the expected rather than the unexpected except for the bizarre and unusual which are found to be more memorable.

3.3.4 Personal experiences (autobiographical memory)

Memory does have its uses. Memory of personal experiences in our own past (autobiographical memory) allows us to associate present and past events, and provides us with a sense of continuity about our lives without which it would be difficult to conceive of a sense of self. It also allows us to share our past and experiences with others, as well as to provide background knowledge for the interpretation of the present.

Autobiographical memory encompasses those aspects of memory which have already been discussed: i.e. memory for objects, places and events. Within the broad framework of autobiographical memory, researchers are keen to answer questions such as: which experiences are most likely to be remembered or forgotten?; what factors make certain experiences memorable?; how much do we remember?; how accurate are our memories?; etc. Out of the large and growing body of research into this aspect of memory, will be selected some studies which may provide some insights into the data which has been collected for this thesis.

In a well-known six-year study of her own memory, Linton (1982) wrote down descriptions of two events that had happened each day. She rated their importance and emotionality at the time of recording, and also at recall. Every month she read two of the descriptions, at random from the ever increasing pile, and tried to remember the events described and their dates. She found that regular events, such as committee meetings, tended to become indistinguishable; they had become absorbed into a general script for those occasions. Some events she found she had completely forgotten. After one year there was little forgetting although after six years, 30% of the recorded events could not be remembered. One surprising result of her study was that she did not find a strong relationship between recall and the importance of emotionality which she rated the events. However, she also found that the ratings she gave at the time of recall did not correspond closely with those she gave at the time of recording.

In a similar study, Wagenaar (1986) recorded 2400 events in his daily life over six years. For each event he recorded *who, what, when and where* plus some further identifying detail. He also rated the saliency (uniqueness), emotionality and pleasantness for each event. At the time of recall, the cue (out of who, what, where and when) was varied, and at the next recall the number of cues was increased. Over a four year period the number of questions answered correctly dropped from 70% to 35%, with recall increasing with the number of cues given. Pleasant events were better remembered than unpleasant or neutral ones, but salience and emotionality also had an effect. The most powerful cue to recall was *what*; *when* was practically useless, with *where* and *who* in between. This

suggests that memories are grouped in categories, and that the information stored in the *what* category is more specific and unique than in the others.

In their study, Rubin and Kozin (1984) asked students to recall three of their clearest memories, and to rate them for national importance, personal importance, surprise, vividness, emotionality and how often they had discussed the event. It was found that events involving injuries or accidents, sports and encounters with the opposite sex were reported most often. The study by Cohen and Faulkner (1988) of elderly subjects showed that memories which received high ratings for importance, surprise and emotionality were also rated as being very vivid - the vividness of the subjects' memories was also significantly correlated with emotionality, importance and the amount of rehearsal. For elderly people, the amount of rehearsal was a better predictor of vividness than emotionality or importance. Events that were remembered most often were: births, marriages and deaths (22.2%); holidays (11.8%); trivia (8.2%); illness/injury (8%); education (8%); family (7.5%); war (6.1%); love affairs (5.1%); recreations/sports (4.4%). It was found that events in which subjects had played a central role were remembered better than those in which they had just a watching role, and unique or first time occasions were also remembered better.

In the studies described so far, the subjects themselves have selected either the memories to be stored or recalled. The rate at which these self-selected events are forgotten is quite slow. Brewer (1988) equipped his subjects with bleepers that went off at random. He asked them to write down the time, where they were, what they were doing, their thoughts and questions when the bleeper went off. Also, they were asked to rate the relative frequencies of their experiences, and their thoughts and actions on a number of seven-point scales. Brewer found that self-selected memorable events have higher recognition memory scores than randomly selected ones, and that the forgetting curves for randomly selected events show considerably more forgetting than those for self-selected events. At the end of five months, 70% of actions were recognised whereas using cued recall only 46% of activities were correctly recalled after two months using the best cue type. However, there were few intrusions or false recalls, In general, Brewer's results showed

that memory for action is better than for thoughts. Moreover, actions which were rated to occur infrequently and in unusual locations, and thoughts which were rated as exciting were recognised more frequently than others. It was found that actions and thoughts serve as relatively good cues for recall. When subjects were very confident about the accuracy of their recall, this was almost always associated with high visual imagery; recalls with high visual imagery were also found to accurate. In general, the results showed that personal memory contains information about actions, locations and thoughts, but rarely about absolute time. Brewer found that the recall of information in autobiographical memory was directly related to its distinctiveness.

When memories are recalled with unusual vividness and clarity they are often termed flash-bulb memories. One of the most quoted examples of this kind concerns the death of President Kennedy. It is claimed that most people can remember what they were doing, who told them, where they were, and how they felt when they heard of the death of President Kennedy. Brown and Kulik (1982) have suggested that there may be a special neural mechanism which *prints* a copy of particularly important, emotional or surprising experience to memory. However, Neisser (1982) believes that schema theory can adequately explain the phenomenon. Whatever the underlying mechanism, there are some memories which are preserved with vivid detailed clarity.

3.4 Memory and Museums

Recalling a "good day out", such as a trip to a museum, and relating it to others seems to be part of human nature. I suspect that museum professionals have often prompted others to recall a museum visit, either intentionally or not. With the increase of recollection studies in psychological research, some studies have been made of subjects' recollections of their museum visits.

In their recent book, Falk & Dierking (1992) reviewed and reported on some museum recollection studies many of which have not been published. In one study of theirs,

individuals were asked to recall a museum visit, often years later, without being given cues. In another study, a class of primary school children was asked to recall their museum visits. The results of these, and other preliminary studies, suggest that an individual's recollections are highly personal and contain much of what he or she *did*, and little information of *where*. Also, experiences which were emotionally either very positive or negative were remembered well, and there was little recall of any content or concept-based information i.e. little of what the exhibits were about.

These studies appear to show that asking for individuals' recollections is a profitable line of research. Through looking at the content of these interviews some preliminary generalisations have been made, although a rigorous analysis of such interviews has not yet been undertaken.

3.5 Memory and Launch Pad

The emphasis in this chapter, and indeed in this thesis, is on the nature of memory, and its workings, and its relevance to the data collected from visitors to Launch Pad. As the literature review in section 2.3 on page 35 revealed, and as the professionals in section 2.2.1 on page 28 hope, the emphasis is often on learning science in ISTCs. Studies of theories of learning rarely seem to mention memory, and vice versa, and there is no space in this thesis for a discussion of the theories of Gagné, Ausubel, Piaget etc. However, White (1988) has drawn on recent theories of learning, and his own experiences, in order to produce a new model for learning science, which does include a discussion of the meaning of certain terms (such as memory, understanding, ability and attitude) which is often avoided by others.

The results of the research into everyday memory which has just been reviewed confirm our general intuitive belief that those memories which are distinctive in some way and pleasurable will be remembered better. Vivid memories will usually be of experiences which were important, surprising or emotional for the person concerned. If the person

was at the centre of the action, rather than a bystander, then the experience will be better remembered, as it will if the experience was a unique or a first-time one. Rehearsal (i.e. replaying the memory to others or to one's self) also leads to vivid memories. If a person is very confident about the accuracy of a memory then the recall of it is likely to be accompanied by high visual imagery. Experiences which involved unique actions, took place somewhere unusual or involved exciting thoughts are more likely to be remembered. There is also a tendency to remember expected details rather than the unexpected unless the details were quite bizarre.

Eyewitness testimony research shows that it is important that questions or cues prompting the recall of memories should contain accurate information and should not lead. It has been shown that asking *what* happened prompts many more memories than asking *when* did it happen, which is practically useless as a cue. Cues referring to unusual actions and exciting thoughts are most effective at getting subjects to recall their experiences. Also, cognitive processing, particularly deep, distinctive or elaborate processing, at the time of encoding can increase the recall of events. Processing which takes place after the initial encoding can also affect recall.

Therefore what should one expect to find when looking at the memories of visitors about Launch Pad over six months after their visit? It would be rather disappointing for the originators of Launch Pad and supporters of ISTCs if little was remembered. If Launch Pad is achieving its educational aims then memories about it should be vivid and contain evidence of thinking. It will be interesting to see whether there is evidence of much rehearsal or of cognitive processing taking place after their visit as well as during their visit. Although it is implausible to expect *much* learning, as "teaching events" only last a few minutes, will there be any evidence to suggest that episodic memories are subsequently processed into semantic ones?

CHAPTER 4 METHODOLOGY

4.1 Introduction

The purpose of this thesis is to consider the long-term *impact* which Launch Pad has on its visitors. It appears reasonable to argue that just *observing* visitors will not provide sufficient evidence of the *effect* the Launch Pad experience is having on them. Therefore, a four stage research study was constructed which would enable data to be collected from visitors, both during their visit and up to about six months afterwards. These four stages are as follows:

(a) Tracking

A small number of visitors (20) were observed, or tracked, whilst in Launch Pad in order to gain a broad perspective of their behaviour and to provide general background information for the development and analysis of the following stages.

(b) Post-Visit Interview

A large number of visitors (396) were given an interview immediately after their visit in order to collect the first impressions of visitors and to provide information for the development of the Follow-Up Interview.

(c) Follow-Up Questionnaire

To assess the impact of Launch Pad once its initial immediate effects had died away a questionnaire was devised and sent two weeks after their visit to those given a Post-Visit Interview. Completed questionnaires were received back from 208 subjects.

(d) Follow-Up Interview

About six months after their visits, an in-depth interview was given to 79 subjects, who had participated in the Post-Visit Interviews. As far as was possible, all tracked subjects were interviewed. The interview was designed to encourage visitors to talk about their experiences through spontaneous recollections so that the impact of the visit could be estimated, and to provide an indication of how much cognitive processing had taken place.

Each of these stages will now be described in more detail.

4.2 Tracking Visitors

The data from observing visitors in Launch Pad does not occupy a central position in this thesis, but it does provide some useful information. A major study based on observation would be a valuable exercise however, particularly for providing evaluative information on the effectiveness of exhibits, and how this varies according to factors such as age, sex, group composition of visitors and the position of the exhibit itself in the gallery. (This will be valid if *effectiveness* has been defined as *attracting* and *holding* visitors' attention.) Therefore the evaluator would need to record all actions (such as reading a label, talking to another person, whether they expressed surprise, looked bored etc). Previous studies of this kind have usually recorded only whether such an action, or interaction, took place rather than how long it took. In this study time is important and so all actions were recorded against time.

Since Launch Pad is a very *public* place I decided to gather the tracking data unobtrusively. By not warning visitors that I was tracking them I hoped to get more accurate data than if I requested their permission first. No subject was aware I was tracking them, although two of the adults accompanying the young visitors whom I tracked did say that they were aware of my presence.

Twenty visitors (10 male and 10 female) were tracked in all; ranging in age from 6 years to adult. The visitors selected had to be part of a family group consisting of at least one adult and one child. Although the *ideal* family group can be considered to consist of a mother and father with two children, one of each sex, between the ages of 8 and 14, these ideal families are rather rare and are not representative of family groups visiting Launch Pad. Therefore, in order to reflect the wide variety of types of family group this ideal was not rigorously adhered to. Tracked visitors were parts of groups as diverse as, for example: a 7 year old boy (track 3) with his mother; an 8 year old girl (track 1) with her sister, mother and grandparents. Apart from subjects having to be part of a family group, subjects were selected so that overall a broad range of ages were represented in the sample and that there were equal numbers of males and females. The first subjects to satisfy the broad criteria described above were selected as they walked into Launch Pad. Tracking in the gallery was done at times when the gallery was likely to be full of family groups; mainly at weekends and during school holidays. Data was collected at all times when the gallery was open on these days, from 31 March 1988 to 25 June 1988. Table J-i on page 268 shows the details of the various groups to which the subjects tracked belonged. A key to the abbreviations used throughout this thesis is given in Appendix I.

It was difficult to assess the composition of a group as visitors entered Launch Pad. Visitors tended to enter, not as discrete groups, but mixed up and it was difficult to judge whether the subject selected was part of an acceptable group until some time had passed. If a subject was found to be unacceptable the tracking was abandoned and a new subject selected.

Launch Pad is large and often very busy with lots of activity taking place. Therefore it would have been extremely difficult to record every action of the subject. Other visitors would have got in the way, and it would have been impossible always to have been in a position to be able to see what the subject was looking at, or reading, or seeing what their reaction was to any particular situation. If a complete track were required then the tracker would have to remain very close to the subject, and naturally do the tracking with the

subject's knowledge. Alternatively, an elaborate closed circuit television could be set up to record every movement of the subject, although the work involved in coding the data in this form is considerable.

A small hand-held computer - the Psion Organiser II Model XP - seemed an appropriate tool for the task of collecting this data. It is small (75 x 140 x 30 mm), easily programmed and it is possible to record data against an internal clock. Being small it was unobtrusive and therefore visitors were not usually aware that I was collecting data. When I was interviewing, using a normal clipboard, I was easily "spotted". The Psion Organiser can store several tracks, although normally only one track was collected in a day as tracking requires a large amount of attention, and reliability can be maintained only for an hour or two.

A series of trials was conducted to refine the tracking method. The key pad of the Psion was covered with small labels denoting the broad activities of visitor behaviour outlined below, and the various refinements which the tracking method allowed. A simple program on the Psion was written to record which key was pressed and when. The resulting data file consisted then of the elapsed time (measured from when the subject entered Launch Pad) and the keys pressed by the recorder.

The computer programs were written to allow for greater flexibility, and for more detail to be collected, than was actually possible in order to allow for future enhancements. The computer program recorded the times the subject spent in four main categories of activity each of which was subdivided into further categories. It was also possible to insert a *flag* showing whether the visitor had expressed surprise or excitement, for example. The trials showed that it was not possible to record this last kind of information reliably. One had to be very close to the subject and to be in front of them to see their faces. This was impossible in the Launch Pad environment. Also, the subjects, especially the younger ones, tended to move very quickly through the busy Launch Pad galleries making it difficult to observe them closely.

Visitors' behaviour in Launch Pad was divided into four main categories of activity:

- Interaction
- Observation
- Moving
- Absence

A subject's behaviour was coded as *interaction* when the subject was clearly interacting with an exhibit. This need not necessarily be equated with physical contact. Some exhibits (such as BIG OPTICS) did not need physical contact. With an exhibit such as BIG OPTICS, if the subject was standing and forming part of the image or looking at the image of someone else then this was coded as interaction. It was usually very easy to tell the difference between interaction and observation.

Observation meant that the subject was observing an exhibit or the visitors using an exhibit. They would not be taking an active part in participating with the exhibit, although they might be engaged in conversation with another observer talking about the exhibit. If the subject talked to a member of their group interacting with the exhibit, giving instructions or directions, without necessarily touching the exhibit, then the activity would be coded interaction. No attempt was made to distinguish between queuing for an exhibit and just watching. Both were coded as observation.

When the subject moved from exhibit to exhibit, looking around to see where to go next, the activity was coded as *moving*. This activity was quite purposeful. The subjects appeared to be actively looking and deciding which exhibit to try next. As the figures later show, children were particularly keen to find the next exhibit. Adults often showed a more relaxed attitude, and moved at a more leisurely pace. *Moving* means that the subject was fully aware of the exhibits around them, although if they stopped to look at a particular exhibit, the activity was then coded as observation.

If the subject appeared not to be in any way paying attention to the surrounding exhibits then this activity was coded *absence*. This does not mean that the subject was necessarily

absent from the gallery. It might mean that they were reading a newspaper, or engaged in a conversation quite clearly unconnected with Launch Pad, or having a drink, or going to the toilet, for example. Absence means that the subject was effectively absent from the essence or nature of Launch Pad.

Although recording visible indications of visitors' emotions whilst tracking was not found to be appropriate, it was possible to record finer detail than the four broad categories previously mentioned. The *moving* category was expanded to include talking to a helper (whilst not at an exhibit) and looking at the information points. *Observation* was split into 6 divisions:

O = observing visitors interacting with an exhibit
OO = observing an *empty* exhibit (i.e. no other visitors attending)
OD = observing and discussing
OR = reading one of the labels
OB = reading one of the *bats*
OH = observing a helper at an exhibit

The data for two of these divisions cannot be relied upon. OD (observing and discussing) could not reliably be coded for reasons described above i.e. being close enough and in front of a group to see whether the subject was discussing with another member of the group the exhibit in front of them. Casual observation suggests however that this form of behaviour is an important aspect of social interaction of family groups.

Little reading of the labels (OR) was observed to take place. However, interviewing subjects revealed that they had read more than I had coded. Obviously, subjects were glancing at the labels and gaining information from them. This form of behaviour was difficult to see from a distance and therefore the OR data is really a record of the time subjects spent clearly concentrating on the labels.

Interaction was split into 6 divisions:-

I = interacting with an exhibit alone

IG	=	"	" " " with the group present
IGV	=	"	" " " " " & other visitors
IV	=	"	" " " & other visitors
ID	=	"	and discussing
IH	=	"	with a helper at the exhibit.

The data for interacting with and discussing an exhibit cannot be relied upon for the same reasons as described above for observing and discussing.

Each exhibit in Launch Pad has a unique number, therefore by pressing the *E* button, followed by a 3 digit number, it was possible to identify the exhibit which was being observed or interacted with. The start activity was always moving by definition, so to start a recording the *M* button was pressed. Subjects were then almost immediately attracted to one of the exhibits and so the recording continued. Each time the subject changed activity the appropriate button was pressed. If they were interacting or observing then the number of the exhibit concerned was also entered. When the subject left Launch Pad the recording was stopped.

The Psion Organiser has an RS232 interface and so the data was transferred to BBC B microcomputer via a serial link where it was converted into a standard data format file ready for analysis. The opportunity was taken at this point to split the data into separate tracks if more than one subject had been tracked in a session.

Each track was then analysed using a specially written program. This program produced a file which, for each second the subject spent in Launch Pad, gives the key pressed, the activity in progress, any flag activated and the number of the exhibit which was being observed or interacted with. Using this converted data a program was written to produce the following information for each track:

- total time spent in Launch Pad (in secs)
- time spent on each main activity (in secs)
- time spent on each detailed activity (in secs)

- indicators (general involvement, interaction, variety, attention span - these are defined later)
- number of exhibits:
  - interacted with and/or observed
  - interacted with and observed
  - interacted with
  - observed
  - total present
- table showing times spent interacting with and observing each exhibit.
- table listing exhibits in sequence by time spent
  - interacting with and/or observing
  - by time spent interacting
- table showing the order in which exhibits were visited

The program was always updated to ensure that it knew which exhibits were present on the day of the tracking and whether they were working or not. The exhibit daily status table in Appendix J shows which exhibits were in Launch Pad on any day and whether they were working or not. Each day the exhibits in Launch Pad were checked to see which ones were present and whether they were in fact working or not. I estimate that this table is only about 95 per cent accurate for the following reasons.

It is very easy to say if an exhibit is present in the gallery or not but more difficult to notice if an exhibit is working properly or not. Perhaps a small part of the exhibit may be missing or a part of it, for example a belt, may be slipping, a few bulbs may not be working and so on. Also it is difficult to know exactly when during the day an exhibit broke down. Ideally the exhibits should be checked immediately before, and immediately after, the visitor has been through Launch Pad and has been interviewed. This was however not practicable. Therefore exhibits were checked at the end of the day and, if in doubt, the exhibit was marked as working because visitors would sometimes try broken exhibits anyway.

There were demonstrations in the gallery on a few of the days on which visitors were

interviewed. These demonstrations were put on by the Launch Pad helpers at irregular times throughout the day. Naturally not every visitor on that day would necessarily be in the gallery at the time that one of these demonstrations was in progress. These demonstrations were given an exhibit number so that observing a demonstration was coded in the same way as observing an exhibit.

4.3 Post Visit Interviews

The overall purpose of the PVI was to get the members of a family group's initial reactions to their visit to Launch Pad, and to gather information about the exhibit which had impressed them most. As this interview was the first part of the long-term study, information was also collected on whether the interviewees wished to participate further in the study. The full text of the PVI is given in Appendix E.

Groups were selected at random as they left Launch Pad. Normally, only family groups (defined as consisting of at least one adult and one child) were interviewed. Exceptions were made for a number of primary school teachers attending a teachers' course at the Science Museum, and a young couple with no children. The first group to leave Launch Pad when data collection started were asked if they would be willing to answer a few questions - it would only take a few minutes. I first introduced myself and explained that we were collecting information mainly to help the Science Museum improve its display. Very few groups refused - those that did usually said that they were in a hurry, to catch a train for example. I then moved the group to a nearby quiet spot or if the south exit was being used, an adjacent room was used to interview the group. Seats or stools were provided in both locations.

I explained that I wanted each member of the group to answer the questions which I would read out from a prepared sheet and that I would fill in the answers on the same sheet. Relevant comments were also on the sheet. The first question was "Have you enjoyed your visit to Launch Pad?" which usually elicited a positive response. The

members of each group often conferred to answer the next question: "How long have you spent in Launch Pad?" to produce a group answer. The last of the simple opening questions was "Have you visited Launch Pad before?".

The next question was prefaced by saying that Launch Pad was different to most museums and Launch Pad was different to the rest of the Science Museum. The question "Compared to what museums normally offer, how do you rate Launch Pad?" was also placed in front of the group on a card together with the four possible responses: (a) much better; (b) slightly better; (c) slightly worse; and (d) much worse. Subjects could either give their response in words or say the appropriate letter.

I briefly explained that the various things in Launch Pad with which they had had a go on were called exhibits before asking "Which exhibit impressed you most?". This often led to several people talking at once so I asked individual members of the group (usually starting with the youngest) to repeat themselves and then to go on to ask "What about it impressed you?" and "What other things did it remind you of?".

Before asking each subject "Do you think you learned anything from this exhibit?" I stated that they would not be expected to explain or justify their answers, but that they could comment further if they wished. The question "Do you feel that Launch Pad is really only for those who are particularly interested in science and technology or is it for everybody?" finished the formal part of the interview.

It was explained that we would like to follow-up the interview in about two weeks time with a two-page written questionnaire and asked if they would be prepared to fill one in and to send it back. If their answer was yes, then their name and address was written down on the back of the questionnaire sheet. Also, they were asked if they would be willing to take part in a follow-up interview in several months' time. The ages of the children were obtained and the time of finishing the interview noted. Notes of relevant comments which people made were written on the questionnaire sheets.

Some interviews were tape-recorded to check that the answers were being correctly coded and written down, and also to have a record of some verbatim comments.

Altogether, 109 groups comprising 396 people (excluding babies in arms) were given a PVI. This does include 13 children (all except one under five and one adult female who answered few questions. Their responses are included where appropriate, and as a consequence the total number of responses varies slightly from one question to another.

Groups varied in size from one to six, with groups consisting of, for example: a mother and her seven year old son; a mother, father and their 13 year old and 10 year old daughters; and a mother, her two children and her parents. The 109 groups interviewed include 10 "groups" of nine female and male primary school teachers who attended a teachers' course in the Science Museum one Saturday. The composition of the PVI groups is given in Table 4-i which shows the number of groups which have a certain number of adults and children in them. Of the 98 groups including children, 47% were composed of two adults and two children. The next most frequent group (21%) was the one composed of one adult and two children, followed by the group composed of two adults

Table 4-i Composition of the groups given a PVI.

No of Adults in Group	No of Children in Group					Totals
	0	1	2	3	4	
1	10	1	21	4	2	38
2	1	7	46	13	3	70
3	0	0	1	0	0	1
Totals	11	8	68	17	5	109

and three children. The average number of children in a family group was 2.19.

The distribution of ages and gender of all those interviewed is shown in Figure 4a which indicates that children in the age range from 6 to 13 are most likely to visit Launch Pad.

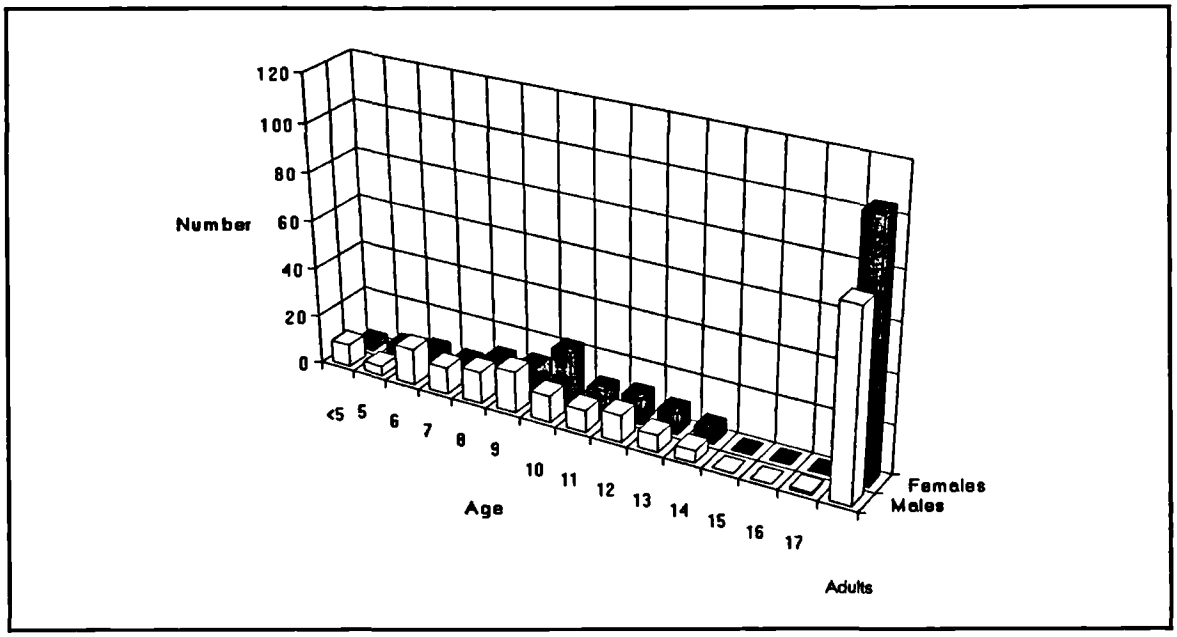

Figure 4a Distribution of age and gender within the PVI groups.

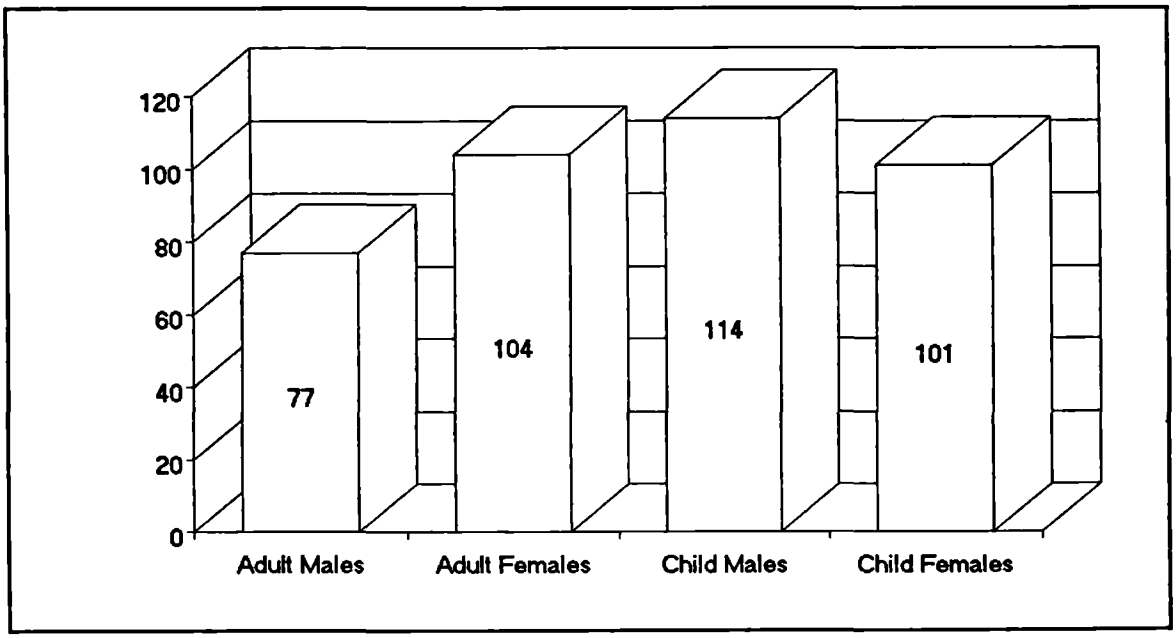

Figure 4b Numbers of PVI subjects by age and gender.

The average of the children's ages is 9.2 years. The numbers of boys and girls were almost equal as shown in Figure 4b, although there were more adult females (26.2%) than adult males (19.5%).

4.4 Follow-Up Questionnaires

Follow-Up Questionnaires were sent out to groups who had visited Launch Pad between 13 August 1987 and 26 June 1988, and who had agreed at the Post-Visit Interview to fill in a questionnaire a few weeks later. A two page questionnaire (together with a covering letter, an envelope and a postage paid sticker) was sent out to each group two weeks after their visit and interview; 50 were returned after an interval of between one and four weeks. In October 1988 it was decided to send out another copy of the questionnaire to all those who had not responded with a letter stating that replies would be appreciated. A further nine questionnaires were returned. Therefore, of a total of 85 questionnaires which were sent out, 59 were returned. This gives an overall return rate of 69.4% which is an encouragingly high figure.

The accompanying letter first thanked visitors for taking part in the PVI and asked if they would complete the enclosed questionnaire according to the instructions (see Appendix F for the text of the questionnaire). Essentially, each group was asked to fill in the answers to the questions - for which there were no *right* answers - whilst in a group. An adult could read out the questions to young members of the group and fill in their answers if necessary. The FUQs were very well filled in and there were few gaps. One group only answered one side of the questionnaire and one adult, to whom the letter were addressed, just filled in her column and not those of the children who had accompanied her on the visit.

The details of the 59 groups who completed and returned their completed questionnaires are shown in Table J-iii. As Figure 4c shows, there is little difference between the two samples of those given a PVI and those completing a FUQ. Therefore it is reasonable to make comparisons between the two groups.

The questionnaire started with a few general questions to assess: (1) how memorable their visit had been; (2) whether they had talked about their experiences with each other or others outside their group; and (c) whether they had recommended Launch Pad to others

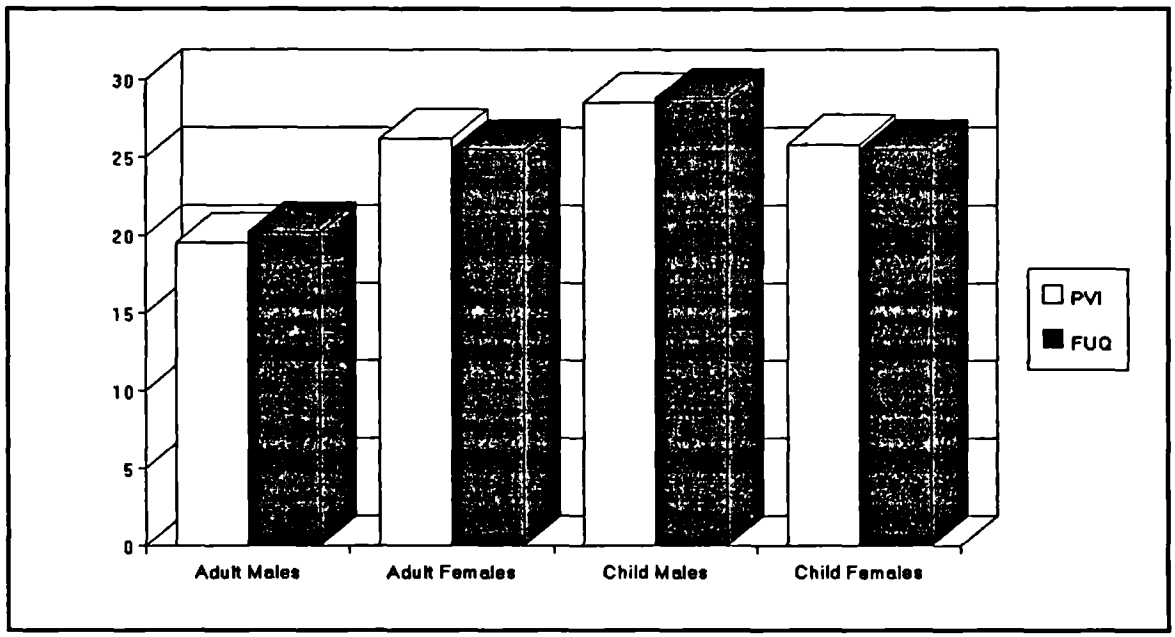

Figure 4c Comparison of samples of those given a PVI and those given a FUQ.

(i.e. to get an idea of how they rated Launch Pad).

The next five questions were concerned with the exhibit that they remembered best and various aspects of their experiences with that exhibit. They were also asked what other part of their day out they remembered well.

There were three questions to assess whether they had a science or technology background, and whether they had an interest in scientific matters or not. They were also asked how many times they had revisited Launch Pad since their PVI. The questionnaire ended with a space for general comments.

4.5 Follow-Up Interviews

The Follow-Up Interview (FUI) was the final stage in the collection of data from visitors to Launch Pad. It involved re-interviewing at length a group who had first been given a Post-Visit Interview (PVI) about 6 months previously. Groups given a FUI were selected from those who had assented to it at the PVI, lived within a reasonable distance

of London and preferably had sent back their Follow-Up Questionnaire. As far as possible, all tracked subjects were given a FUI. Efforts were made to ensure that all members of the original group were present for the FUI, which usually took place in the visitors' own homes or occasionally in the Science Museum before they re-visited Launch Pad. The members of the group were interviewed together and the replies of each member were recorded. Typically the FUI lasted about one hour, although sometimes it lasted two hours. Details of the groups given a FUI are shown in Table J-iv.

My general impression was that groups were genuinely pleased to be interviewed; they had found their visit to Launch Pad to be a very positive experience and they were keen to talk about it. Also, they expressed pleasure that someone from the Science Museum found them interesting enough to come to talk to again. For me, no interview was disagreeable although some were better than others. In a few interviews, some of the children in the group were a bit awkward (i.e. reluctant to talk) which increased the tension between them and their parents who wanted them to perform. This behaviour is not uncommon, particularly in front of strangers. It was more usual however for the children to be quite voluble. Despite their welcome it was clear that groups did not feel that they only had to tell me the nice things. The length and nature of the interview was such that they were able to be critical if they wanted to.

Twenty four groups (79 subjects altogether) were given a Follow-Up Interview, and these

***Table 4-ii** Composition of groups given a Follow-Up Interview.*

	Males		**Females**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**
Adults	14	(17.7)	21	(26.6)	35	(44.3)
Children	21	(26.6)	23	(29.1)	44	(55.7)
Totals	35	(45.3)	44	(55.7)	79	(100.0)

(There were 24 groups)

were composed as shown in Table 4-ii.

The main purpose of the FUI was to collect visitors' memories of their experiences in Launch Pad in order to estimate the impact of the visit. The number and quality of the memories which are recalled are an indication of the memorability of a Launch Pad visit - also, analysis of the memories will indicate how much cognitive processing took place at the time or subsequently. Therefore, the essential aim of the FUI was to encourage visitors to talk about their experiences, ensuring as far as possible that their recollections were spontaneous. Their recollections were not pursued with supplementary probing questions to try, for example, to discover whether they had enjoyed a particular exhibit or what they had done with it. Only encouragement was given, either in the form of "Tell me more about it" or to just repeat what the visitor had said.

Occasionally, parents who were really only trying to get their offspring to talk, would ask direct questions such as "What did you do with it?", "What did it look like?", "What was it meant to show?" etc. The vast majority of accounts however came from prompting statements of the form "Tell me about an exhibit you remember well."

All interviews were tape-recorded and subsequently transcribed; each resulting in a document of between approximately 5,000 to 16,000 words.[1] Notes were taken in case the tape recorder, or its operator failed (which in fact it did partially on two occasions) and also to indicate who was saying what; it was sometimes difficult to identify correctly the voices of children on the tape. Afterwards, some general notes about the interview were also made.

The FUI was structured in the following way:-

A Preamble

B Practical Information

C Spontaneous Recall

[1] See Appendix I for the abbreviations used in the transcripts.

D Prompted Recall

E Further Exhibit Recollections

F Feelings

G Miscellaneous

H Conclusion

The text of the Follow-Up Interview questions is given in Appendix G.

The purpose of the preamble was to put the group at ease, to explain what was going to happen and to explain the purpose of the FUI. It was emphasized that information was being collected to improve the Museum's display and that it was not a test. Permission was asked to tape the interview (it was never refused) although they were asked if they wanted to ask any questions before the tape recorder was started (generally none were asked).

Section B consisted of a few questions on practical matters (concerning, for example, the date, time and length of visit) which were designed to put the group at ease and used to answering questions. Discussion amongst the group was not discouraged and therefore there was usually some debate about what the date of their visit was or how long they spent in Launch Pad. For questions in this section a general consensus answer was recorded.

The first question in Section C on spontaneous recall was "Which part of your whole day out do you remember best?". It was stressed that the whole day out meant from the time they stepped out of the front door to the time they got back home. Each person in the group was asked to give their own answer, but other members of the group were allowed to join in if they so wished. It was quite usual for one person to remind another of something that had happened or to spark off another recollection.

The group was then asked to concentrate on the Launch Pad part of their visit. The next question "Which exhibit do you remember best?" was repeated to allow people time to

think and the word exhibit was explained to make sure everyone knew what was meant by the question. The phrases "Tell me about it" or "Tell me more about it" were used to encourage people to answer or to answer more fully. Most people needed no prompting and immediately launched into describing their remembered exhibits. Parents sometimes paraphrased this question into, for example, "Which exhibit did you like best?" or sometimes "Which one did you have most goes on?". Fortunately, these unwanted prompts, encouraging an affective or descriptive response respectively to the questions above, were few.

In section D, subjects' memories were then prompted by showing 15 photographs of Launch Pad exhibits. The 15 photographs selected included all exhibits which a group had mentioned either in the PVI or the FUQ and:

- one or two exhibits which were not there when they visited
- some *popular* and *unpopular* exhibits according to the results of the analysis of the tracking data
- one or two exhibits which were not working
- exhibits which were, from the tracking data, rated as of high ***interactivity*** and high ***observation***, low ***interactivity*** and low ***observation***, and those mid-way. [2]

Every member of the group was asked if they had seen the exhibit in each photograph and whether they had had a go on it.

I had prepared an album of photographs of the exhibits in use with each photograph numbered with the exhibit number; they were snapshots rather than studio shots. Before the interview I prepared the list of 15 photographs and then in the interview I could draw the group's attention to any particular photograph by using the exhibit number. On a flag above each exhibit was the exhibit number (for staff convenience - no visitor ever referred to these numbers) and the exhibit name. In my estimation, few visitors referred to the exhibit by the name which the staff had given to it - they preferred to use their

[2] See Chapter 5 for a description of these terms.

own names. In the photographs however, the exhibit names were clearly visible and subjects often read the names and used them in the discussion.

In the next section E, subjects were asked to talk more about some Launch Pad exhibits which they remembered. Question E1 asked each person to talk about an exhibit they would tell someone to avoid. They were also asked to explain why it was an exhibit to be avoided, if they did not spontaneously do so.

The next three questions concerned exhibits which they either felt they did or did not understand. They talked about one of each and then they had a free choice. It was emphasized that they were not going to be asked for a detailed technical explanation; they just had to talk about the exhibit in the same kind of way as they had done previously. Each member of the group was then asked whether they could remember any exhibits which were not working, if any, when they visited. To finish off this section they were asked if they had noticed any of the Launch Pad staff and, if so, to describe what they were doing.

Section F concentrated on visitors' feelings towards Launch Pad. As an introduction, each member of the group was given a piece of paper with 15 phrases on it. They were asked to tick those phrases which they thought best described Launch Pad. The very youngest members of a group sometimes needed assistance in reading the phrases and working out what they meant.

The succeeding questions were deliberately open-ended, hoping to allow visitors to say what they really felt. By this time in the interviews everyone appeared relaxed and to be talking freely. So the questions "What do you think you got out of your visit?" and "How do you feel about Launch Pad?" produced a range of responses from a simple "I enjoyed it." to a long and detailed account of what they thought the benefits of a visit to Launch Pad were. No-one reported that their feelings had changed since the day of their visit.

In order to find out whether a visit was followed by any activity sparked off by a Launch

Pad visit, I then asked: "Did your visit prompt you to follow it up in any way? If so, how?". It was emphasized that following it up included just talking about it to making something based on what they had seen. This section ended by asking how they rated a visit to Launch Pad as part of a day out, and how much they would be prepared to spend on travelling in order to visit Launch Pad.

The next "Miscellaneous" section continued the winding down process. The general idea of the questions in this section was to investigate how much visitors remembered of events which took place near the time of their Launch Pad visit. This it was hoped would give an indication of how memorable their Launch Pad visit had been.

In the "Conclusion" section, visitors were asked whether they wanted to go back over anything; to add, amend or take away anything they may or may not have said. They were also invited to ask me questions and to comment on the interview itself. Finally, they were thanked for being helpful.

4.6 Predicting the Results

Earlier in this thesis, in section 2.2, I presented views of those people working in an ISTC, or closely involved with one, on what they hope and what they think actually happens in an ISTC. Having described my research to a small number of ISTC professionals, and a group of schoolteachers, I asked them what they thought the results from the Follow-Up Interviews (FUIs) might be expected to show. This was done using a short questionnaire which each person filled in themselves.

The reason to do this was that it is inevitably difficult to assess the results of a exploratory study such as the present one. Few clear predictions can be made, which the results then test. It therefore seemed useful to collect a sample of experts' *expectations*, with which the results could be compared.

A copy of this *expectations* questionnaire is given in Appendix H. It briefly describes the FUI, and then gives twenty five statements about visitors' possible reactions or responses to a Launch Pad visit. Subjects were asked to state whether they (a) agreed strongly, (b) agreed slightly, (c) disagreed slightly or (d) disagreed strongly with each statement. They could also indicate whether they did not know what the result would be.

The *expectations* of a group of 26 delegates on a teachers' course at the Science Museum will be presented first - see Table J-v in Appendix J. Replies were averaged to produce an indicator of the group's overall response to each statement, ***Agreement*** using scores:

agreed strongly	+ 2
agreed slightly	+ 1
disagreed slightly	- 1
disagreed strongly	- 2
don't know	0

and normalised to range from - 1 to + 1.

From this analysis it is clear that the group of teachers expected visitors to talk a lot about how much they had enjoyed themselves and about exhibits which they had enjoyed. They expected visitors to recall vividly certain exhibits and to talk a lot about what they had done with the exhibits. It was expected that visitors would think it was great day out, and that it was very educational.

There was little agreement on whether visitors would talk about (a) what other people did with the exhibits, (b) exhibits they found easy to do, (c) exhibits they did not enjoy, or (d) what the exhibits looked like. Also, there was no consensus as to whether visitors would provide scientific explanations or not.

A smaller group consisting of 8 ISTC professionals were also given the questionnaire and the results were analysed in the same way as for the group of teachers - see Table J-vi in Appendix J. The expectations of the professionals and the teachers appear quite similar. Spearman's Rank Correlation Coefficient, defined as:

$$R = 1 - \frac{6\Sigma d^2}{n^3 - n}$$

where d = difference in ranking

n = number of statements ranked

was calculated for the two rankings and found to be 0.84. Students' t, defined as:

$$t = R\sqrt{\frac{n-2}{1-R^2}}$$

was calculated as 7.5. For 23 degrees of freedom the 1% level of confidence for t is 2.8. This indicates a highly significant degree of correlation between the two rankings.

The main differences in the professionals' and teachers' expectations are as follow. The professionals thought that visitors would talk a lot about what the exhibits looked like whilst the teachers thought otherwise. The professionals also thought that there would be more differences between the reactions of males and females than did teachers. Teachers agreed more with the statements that visitors would not recall exhibits which were not working, and that visitors would often provide scientific explanations, than did the professionals.

CHAPTER 5 TRACKING

5.1 Introduction

I decided to track a small number of visitors for the whole time they were in Launch Pad in order to gain a broad perspective of visitors' behaviour in Launch Pad. General patterns of behaviour were investigated rather than a detailed recording of a visitor's every action. Tracking was also used to provide general background information which would be useful when analysing the Post-Visit and Follow-Up Questionnaires, and when formulating and asking the questions in the Follow-Up Interviews. Every effort was made to obtain Follow-Up Interviews with all those visitors who were tracked and their associated family groups. So the collection of tracking data was part of the selection process of groups for study.

Details of how the data were collected are given in section 4.2 on page 69. The raw tracking data which were collected are given in the tables in Appendix K.

The analysis of the data collected from tracking 20 visitors in Launch Pad is divided into two sections:

- analysis of the data on the *visitors* and their general behaviour
- analysis of the data on the *exhibits*

5.2 Visitors' data

5.2.1 Analysis by activity times

Figure 5a shows the total time spent by each tracked subject in Launch Pad. These times range from just under 40 minutes to nearly 90 minutes, median 1 hour, IQR 30 minutes. These values are not particularly surprising as on most days on which this data was

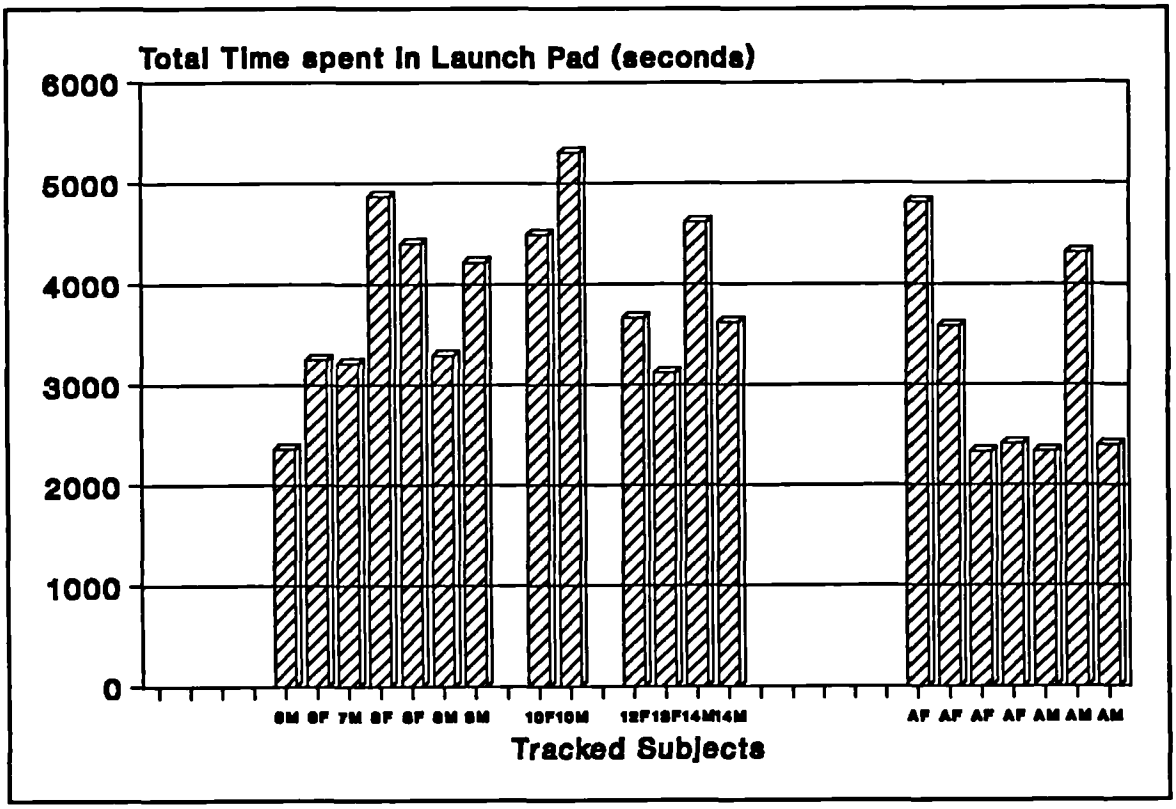

Figure 5a Total time each subject spent in Launch Pad.

collected the ticketing system for Launch Pad was in operation. On busy days visitors are given a ticket which gives them entry to Launch Pad at a certain time. This enables visitors to spend their queuing time moving around the rest of the Science Museum. On ticketing days visitors are restricted to one hour in Launch Pad.

A survey was made of the times visitors spent in Launch Pad when there were no constraints on the time they were allowed. A frequency table of these times is given in Table 5-i. This shows that most people prefer to spend an hour in Launch Pad indicating that the tracked figures are not unrepresentative.

Figure 5a reveals that there is little difference between the ages, or between the sexes. All subjects in this sample were part of a family group. These figures represent a fairly coherent picture of the spread of times spent by a family group in Launch Pad, and not a picture of individuals. Therefore it is not surprising that there is little detectable difference.

***Table 5-i** Frequency distribution of times of length of stay with no ticketing.*

Length of Stay (minutes)	n	%
0 -19	116	10.6
20 - 39	353	32.3
40 - 59	302	27.6
60 - 79	191	17.5
80 - 99	82	7.5
100 - 119	20	1.8
120 - 139	17	1.5
140 - 159	2	0.2
160 - 179	8	0.7
180 - 199	0	0
200 - 219	0	0
220 - 239	1	0.1
240 - 259	2	0.2
TOTALS	**1,094**	**100.00**

As explained in section 4.2 on page 72, visitors' behaviour in Launch Pad was divided into four main categories of activity: Interaction, Observation, Moving and Absence. Figure 5b shows how the percentage time spent on each activity varies from subject to subject. The time spent interacting has been expressed as a percentage of the total time, and similarly for observing, moving and absence. In general terms we can see that children spend about 20% more time *attending* to the exhibits than adults (attending is defined as either observing or interaction). Also, children spend more time interacting than observing, whereas adults spend more time observing than interacting.

The times spent on each of these main activities will be considered in more detail. Absence% (the percentage time spent being absent) - which is plotted in Figure 5c - is made up of three components:

- completely uninvolved with Launch Pad
- having a drink, or going to the toilet
- subject out of sight of observer (i.e. lost)

It was not uncommon to lose sight of tracked subjects in Launch Pad, especially when the gallery was crowded. The *absent* category overestimates the times spent not attending because it includes subjects who were temporarily unable to be observed. The values of Absence% range from 0% to 15% with a median value of 2.4%, with no obvious

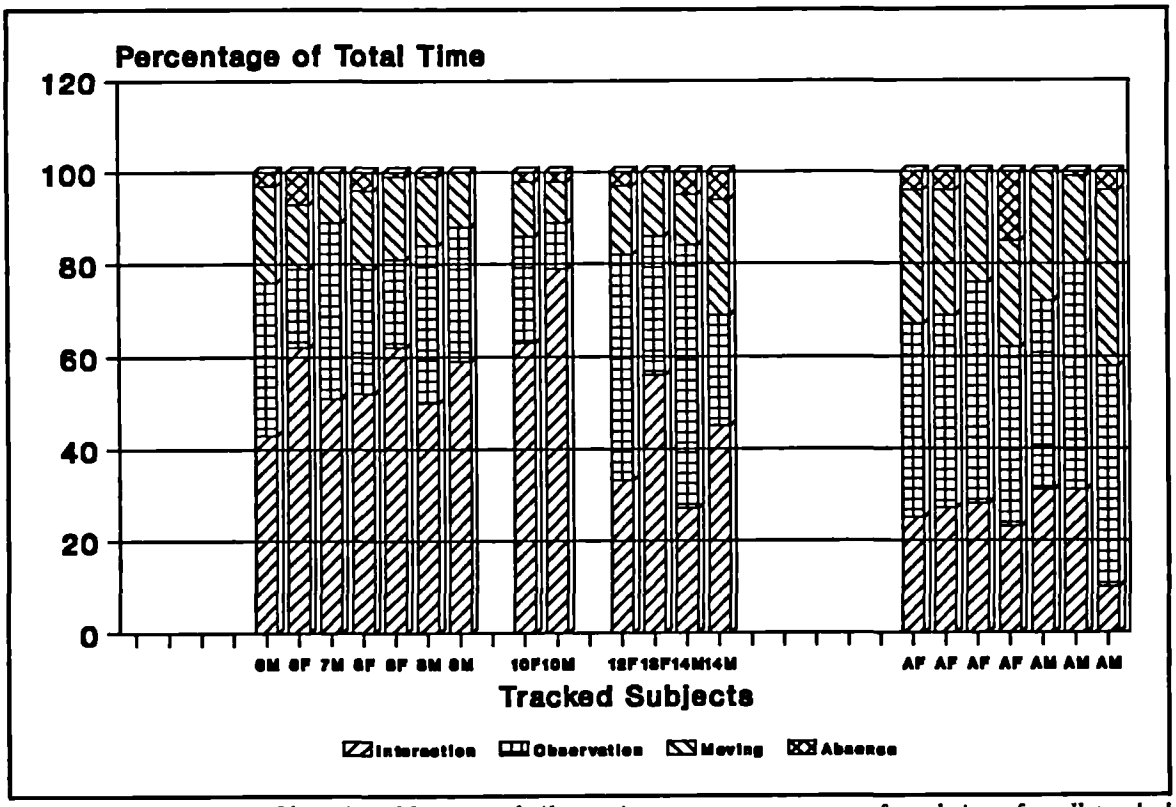

Figure 5b Interacting, Observing, Moving and Absent times, as a percentage of total time, for all tracked subjects.

dependence on age or sex. Most of the contribution to Absence% comes from the last two components (drink/toilet and lost). Only 3 subjects (14M, AF, AF) were genuinely absent for 11, 134, and 320 seconds respectively. Overall these periods of genuine absence amount to just 0.64% of the total time all the subjects spent in Launch Pad. This low figure indicates that Launch Pad is effectively holding the attention of its visitors whilst they are in the gallery.

The time spent moving as a percentage of total time spent in Launch Pad (Move%) for each subject is shown in Figure 5d. Clearly, adults tend to spend more time moving than children. The mean value of Move% for children is 15% compared to 27% for adults, although there is considerable variation. Whilst moving, only one subject (AF) talked to a helper and that for nearly 5 minutes. Five subjects visited one of the information points; two made just a cursory visit whilst the other three spent more than half a minute there.

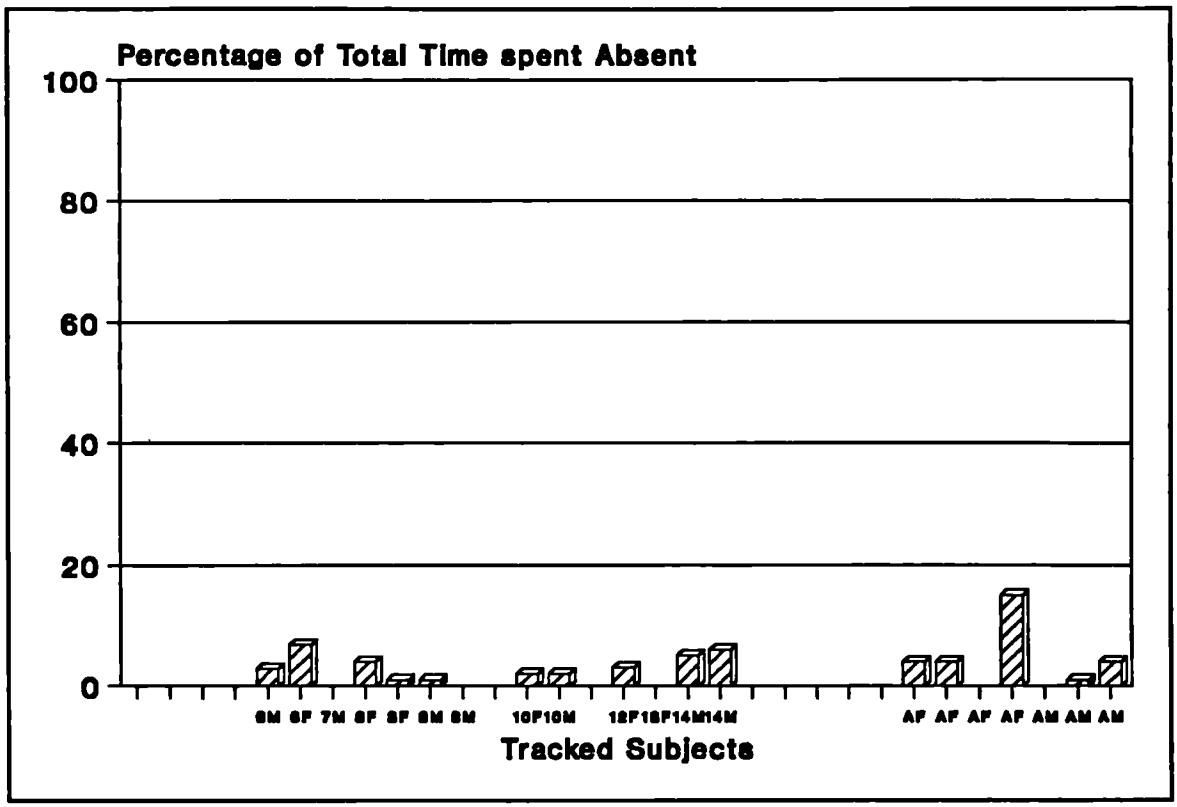

Figure 5c Absence times, as a percentage of total times, for each tracked subject.

The time spent observing as a percentage of the total time spent in Launch Pad (Observe%) for each subject is shown in Figure 5e. There is a wide variation from 10% to 57% amongst children, with less amongst adults, although the data suggest that older children and adults spend more time observing than young children.

Although the twenty tracked subjects spent nearly seven hours observing between them less than four minutes of it was spent observing an *empty* or unused exhibit. Most of it was spent observing exhibits in use or observing demonstrations. One reason for this is that Launch Pad is normally busy and therefore there are relatively few unused exhibits. Also, visitors would tend to approach an unused exhibit and interact with it directly. However, there also appeared to be a certain reluctance on the part of visitors to approach an unused exhibit. They seemed to be more attracted to the crowds around a popular exhibit and were inclined to be slightly suspicious of an empty exhibit, perhaps thinking that it could not be any good if no-one was using it.

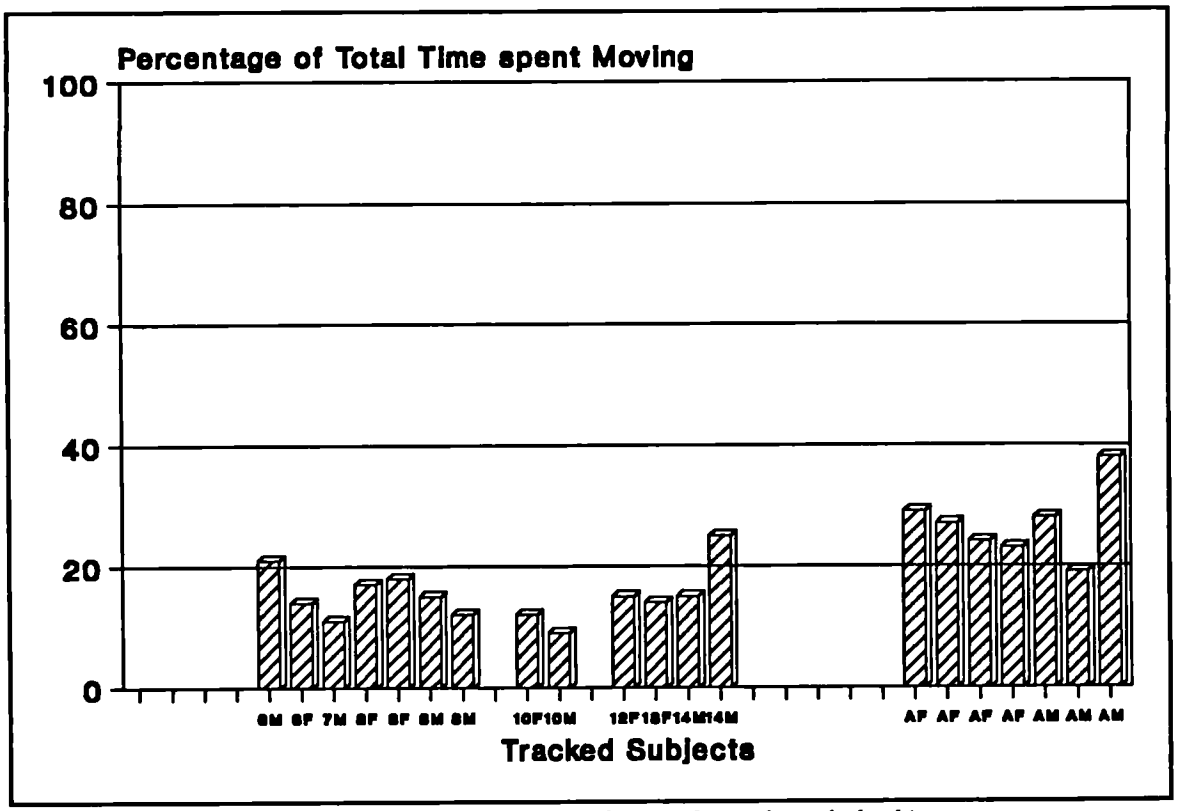

Figure 5d Times spent Moving, as a percentage of total times, for each tracked subject.

Eleven of the subjects were seen to read a label, four of these for six seconds or less. All of the adults except two were seen to read labels but less than half of the children did so. The median total reading time is sixteen seconds, ranging from two seconds to sixty seconds. No-one spent more than 1.5% of their time in Launch Pad reading labels. These low figures are not completely unexpected. For reasons mentioned earlier, and from remarks made in interviews with subjects, it is apparent that visitors do glance at and glean information from labels without overtly studying them.

The *bats* in Launch Pad are designed to give further information about exhibits to those visitors who require it. The bat has to be picked up to be read and therefore the data collected on bat reading times is quite reliable. Six subjects picked up a bat and spent from nine seconds to forty two seconds reading, with a median time of twenty two seconds. Only one of these subjects had not been seen to read a label suggesting that it is more likely a visitor will read a bat if they have read a label.

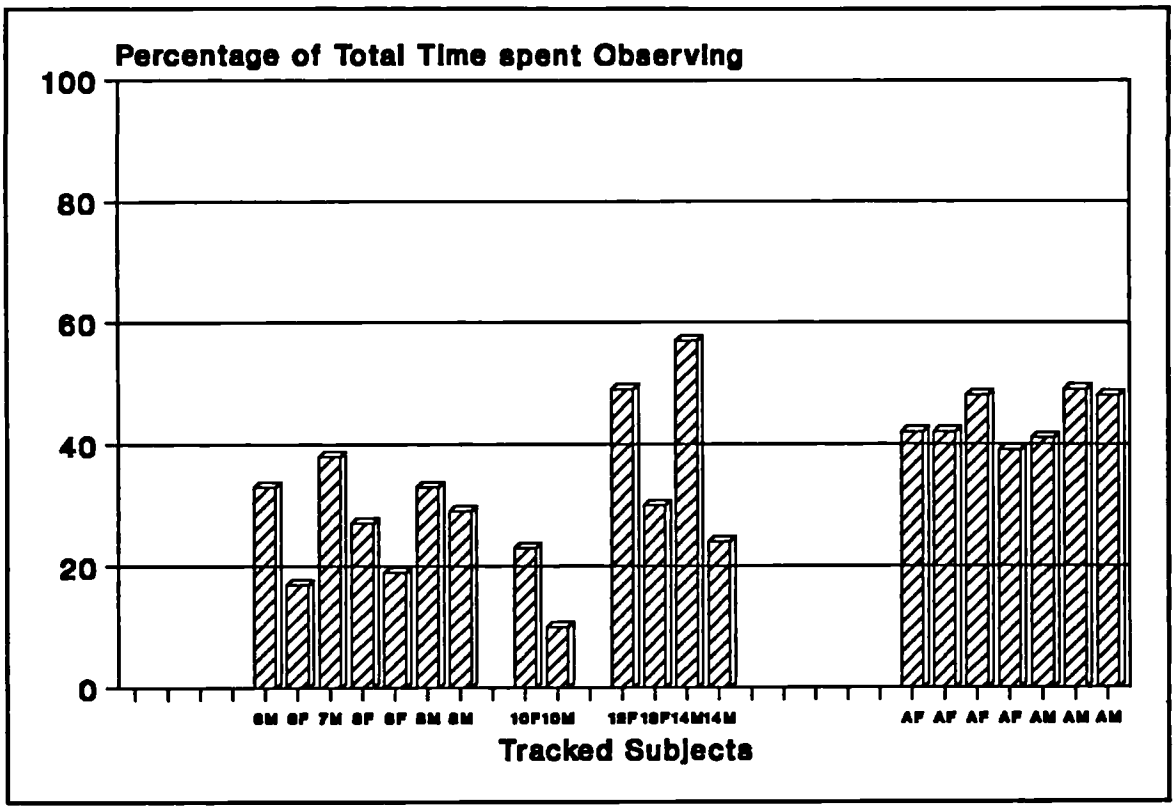

Figure 5e Time spent Observing, as a percentage of total time, for all tracked subjects.

Six of the tracked subjects watched a demonstration, spending from forty seconds to over twenty one minutes doing so, with a median time of about seven and a half minutes. An adult female spent twenty one minutes watching two demonstrations. It is clear that demonstrations are popular and do attract people. If more demonstrations had taken place when the other subjects were in Launch Pad then they probably would have watched them.

Of the four main categories, the percentage times spent interacting (Interact%) show up the most striking differences between adults and children, as shown in Figure 5f. On average, children spend just over half of their time in Launch Pad interacting with the exhibits whilst adults spend only a quarter of their time interacting. Adults and children differ in how they interact with other visitors at exhibits. For example, the amount of time the subject spent at exhibits with other visitors but with no member of their own group present was recorded. Only two females out of the seven adults tracked spent any time interacting with other visitors in this way, both for less than 10% of their total times

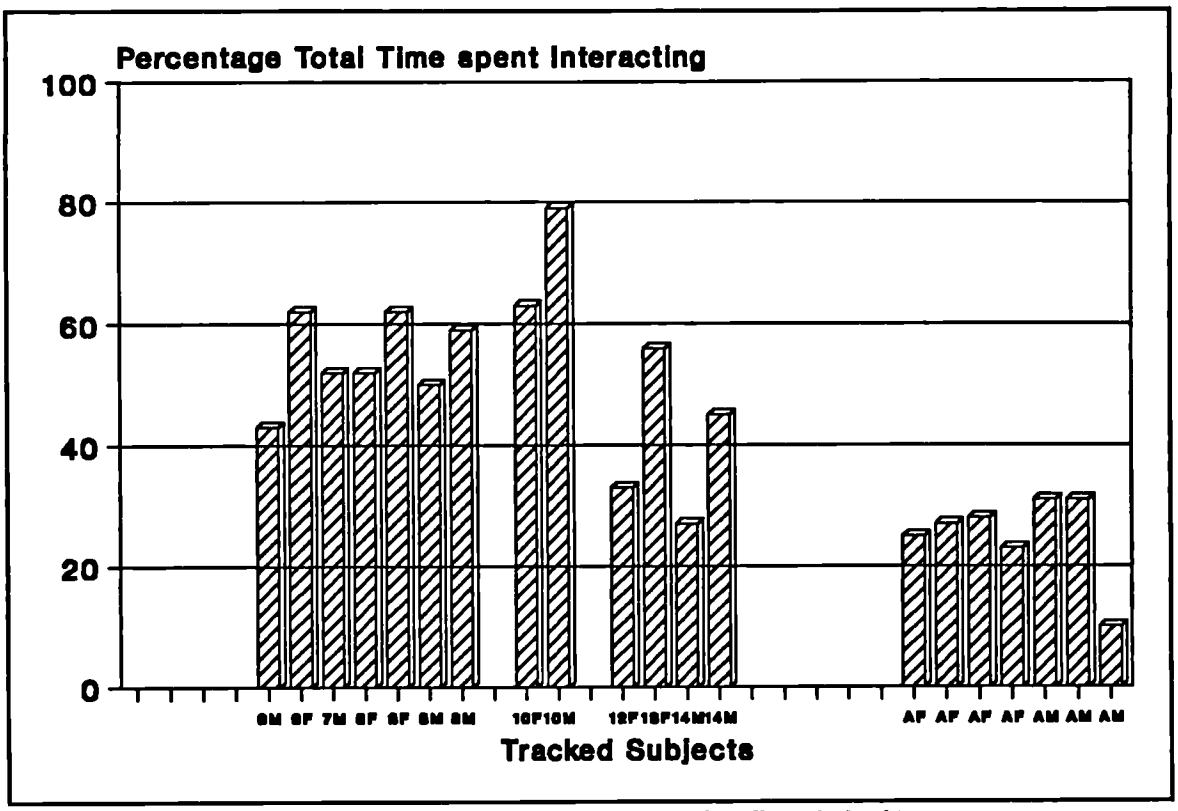

Figure 5f Time spent Interacting, as a percentage of total time, for all tracked subjects.

spent interacting. In contrast, all the children interacted with other visitors at exhibits, spending up to 80% of their time interacting with others. On average, children spend 24% of their time spent interacting away from their group with other visitors, whereas adults interact less than a quarter as much in this way. Adults are also reluctant to interact on their own with an exhibit. They prefer to interact with an exhibit with just their own group present. Adults, however, do spend more time than children interacting with other visitors when they are in their own groups at an exhibits. Presumably these differences may be partly due to the social norms governing the expected behaviour of children and adults.

5.2.2 Analysis by quarters

The times spent moving, observing, interacting and being absent were also analysed over the four quarters of the visit (a quarter of the visit being defined as the total time divided by four). The percentage amount of time spent on each of the four main activities in each quarter is shown in Figure 5g (there is insufficient data for the variation of absent% to be

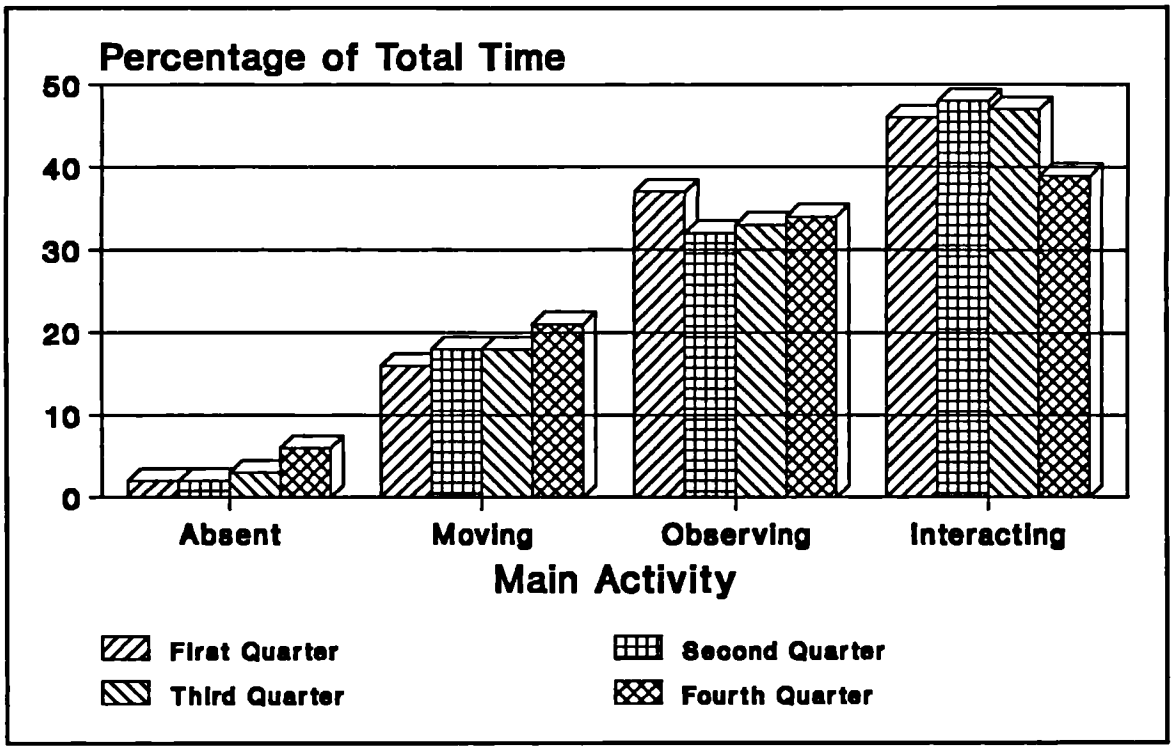

Figure 5g Mean percentages of times spent Absent, Moving, Observing and Interacting throughout the four quarters of a Launch Pad visit.

reliable).

Children spend about 13% of their time moving during the first three quarters of their visit, although this rises to 18% in the final quarter. Adults move for 21% of their time in the first quarter but this rises to 29% for the remaining three quarters. Adults are most interactive in the second quarter of their visit (32%), but the other quarters are of the order of 23%. As mentioned earlier, children are about twice as interactive as adults, and they are consistently so for the first three quarters of their visit.

Overall, these figures show remarkably little variation in visitor behaviour over the length of the visit. Children attend to the exhibits for 84-86% of the time during the visit dropping to 78% in the last quarter. The similar figures for adults are 80-83% and 73%. Therefore right up until they leave the gallery visitors are spending about three-quarters of their time attending to the exhibits.

5.2.3 Analysis by numbers of exhibits observed etc

Another way of considering how visitors attend to exhibits is to look at *how many* exhibits they interact with or observe. For each tracked visitor the number of exhibits which fell into the following categories were counted: (i) observed; (ii) interacted with; (iii) observed or interacted with or both; (iv) both observed and interacted with; (v) only interacted with; (vi) only observed; and (vii) neither observed nor interacted with. These figures are given in Table K-ii in Appendix K. Adults have a slight tendency to *observe only* more exhibits than children (see Figure 5h). This agrees with the earlier result that adults spent

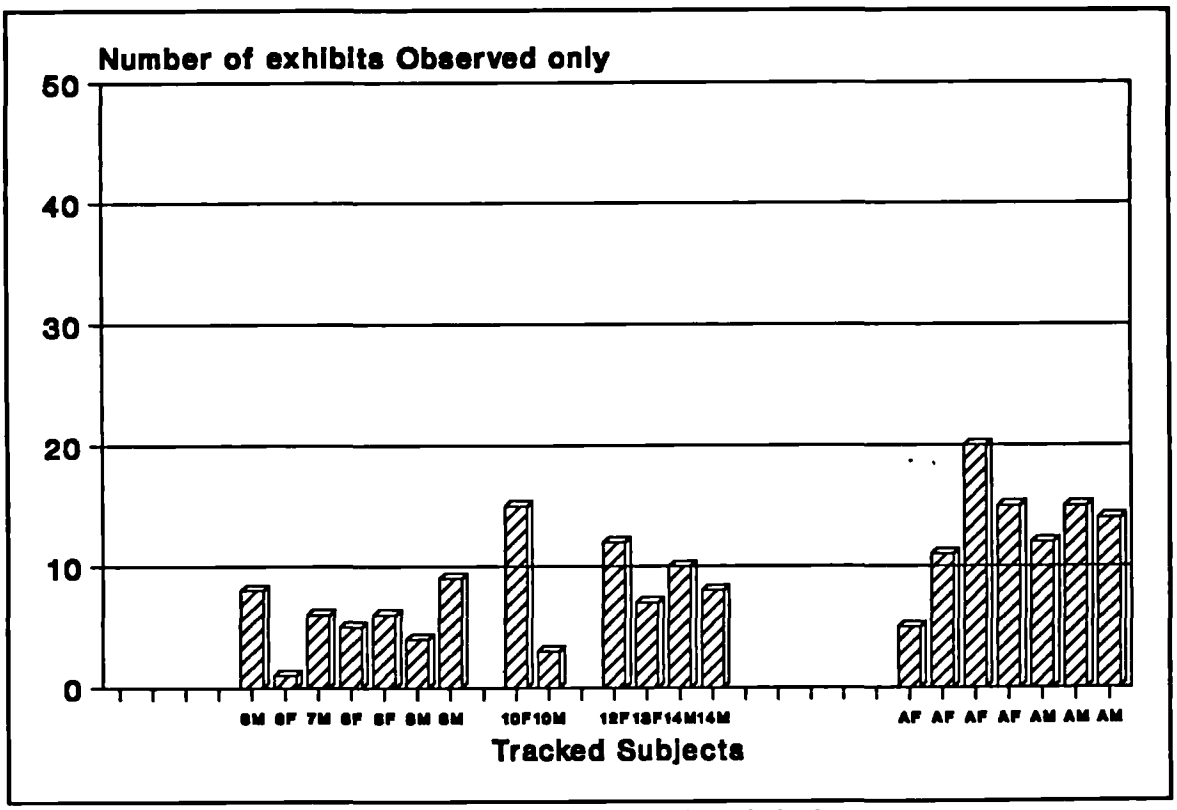

Figure 5h Number of exhibits which were Observed only for all tracked subjects.

more time observing. Adults however interact with fewer exhibits than children (see Figure 5i). The number of exhibits attended (attending has been defined as either interaction or observation) to by all the tracked subjects is shown in Figure 5j. This indicates that on average, adults attend to more exhibits than children.

As there are considerable differences from subject to subject, and the collected data is

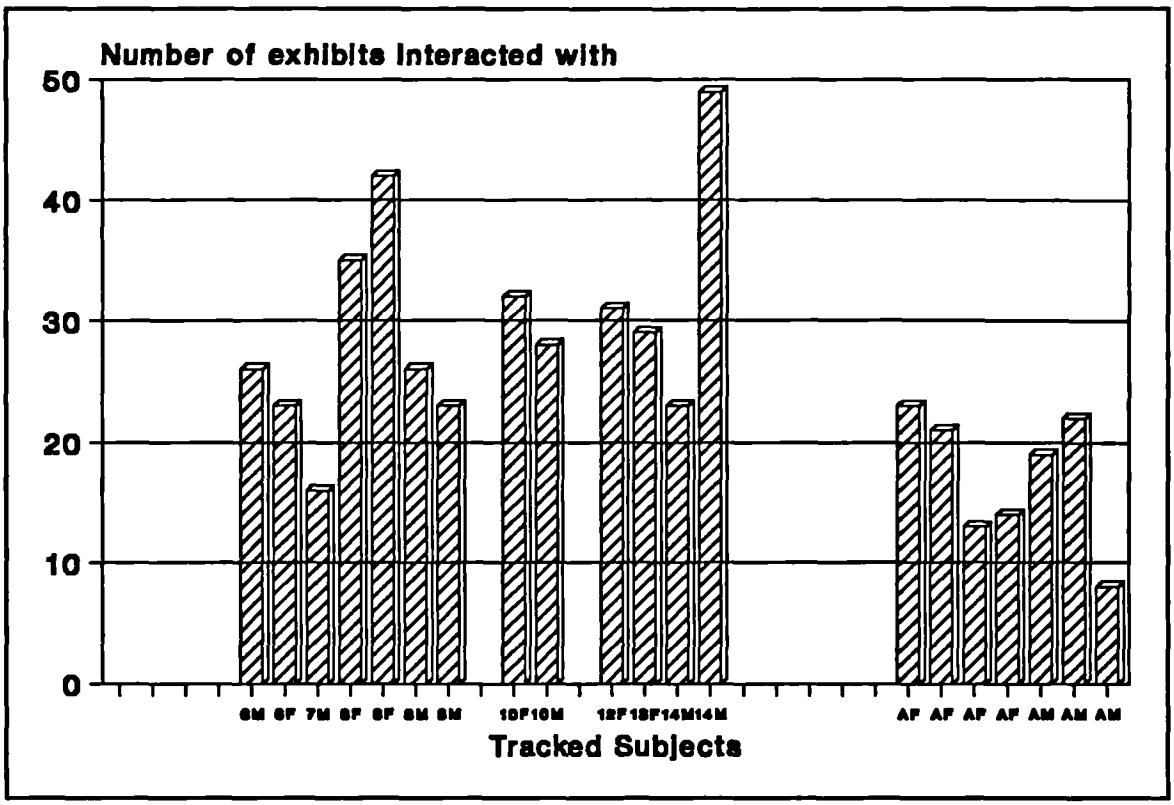

Figure 5i Number of exhibits Interacted with by all tracked subjects.

extensive and detailed, certain indicators have been defined to clarify trends and characteristics about the subjects tracked from within the data. These are called ***General Involvement, Interactivity, Variety, Attention Span, Hands-on*** and ***Returnability.***

General Involvement (see Figure 5k) gives an indication of how much time a subject spends observing and interacting with exhibits. It is effectively the amount of time spent attending to exhibits as a percentage of the total amount of time spent in Launch Pad.

Interaction (see Figure 5l) is the amount of time spent interacting with exhibits as a percentage of the total amount of time spent in Launch Pad.

Variety (see Figure 5m) indicates how many different exhibits a subject attends to whilst in Launch Pad. It is defined as the number of exhibits attended to divided by the total number of exhibits in Launch Pad.

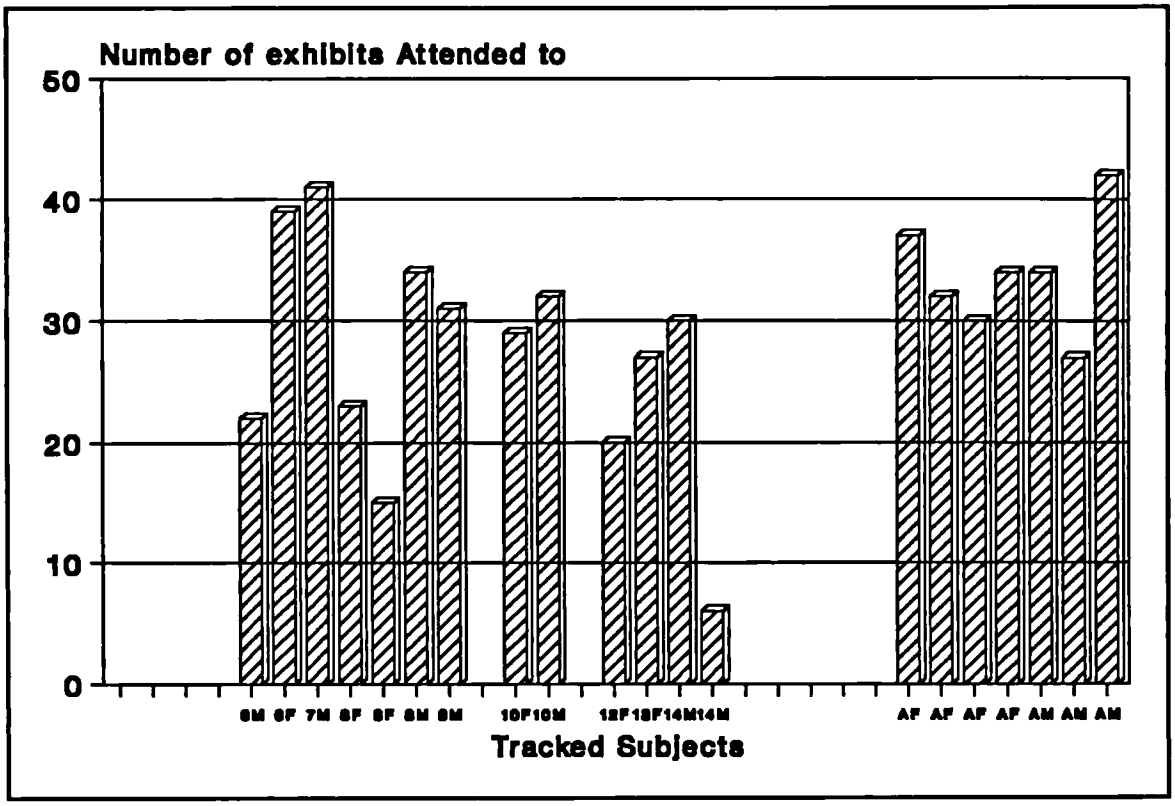

Figure 5j Number of exhibits Attended to by all tracked subjects.

Attention Span (see Figure 5n) gives an indication of how long a person spends at each exhibit. It is defined as:

$$\frac{(observe\ time + interact\ time)}{(no\ of\ exhibits\ observed + no\ of\ exhibits\ interacted\ with)}$$

Hands-on, which is the number of exhibits interacted with divided by the number just observed (see Figure 5o), indicates how much visitors are prepared to get their hands on things rather than just watch.

When collecting the tracking data, I observed that the behaviour of the subjects did vary in the way that they went from exhibit to exhibit. Some subjects always seemed to go to a *new* exhibit (i.e. one they had not seen before), whilst others returned many times to an exhibit they had previously either observed or interacted with. As a measure of this

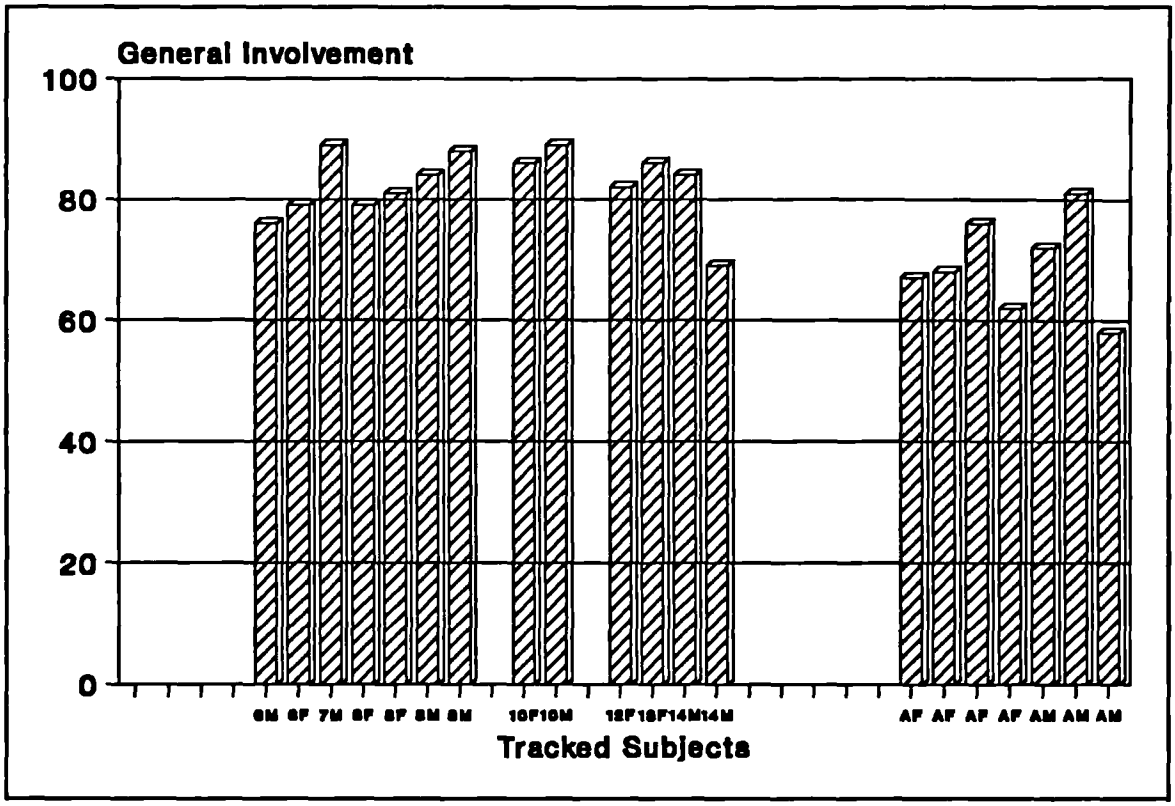

Figure 5k "General Involvement" for each of the tracked subjects.

observation, ***Returnability*** of a subject was defined as:

$$\frac{(\textit{no of exhibit visits made})}{(\textit{no of exhibits visited})} - 1$$

Figure 5p shows that the ***Returnability*** of the tracked subjects varied from 0.09 (7M) to 0.68 (8F). It appears that adults are less likely to return many times to an exhibit than children and that there is little difference between males and females.

Although there are considerable differences between the subjects, the data suggest that it is possible to make the following generalisations:

- children are significantly more involved than adults
- children are twice as interactive as adults and much more *hands-on*
- children attend to slightly fewer exhibits and they pay attention for longer than adults
- males and females are equally involved and interactive

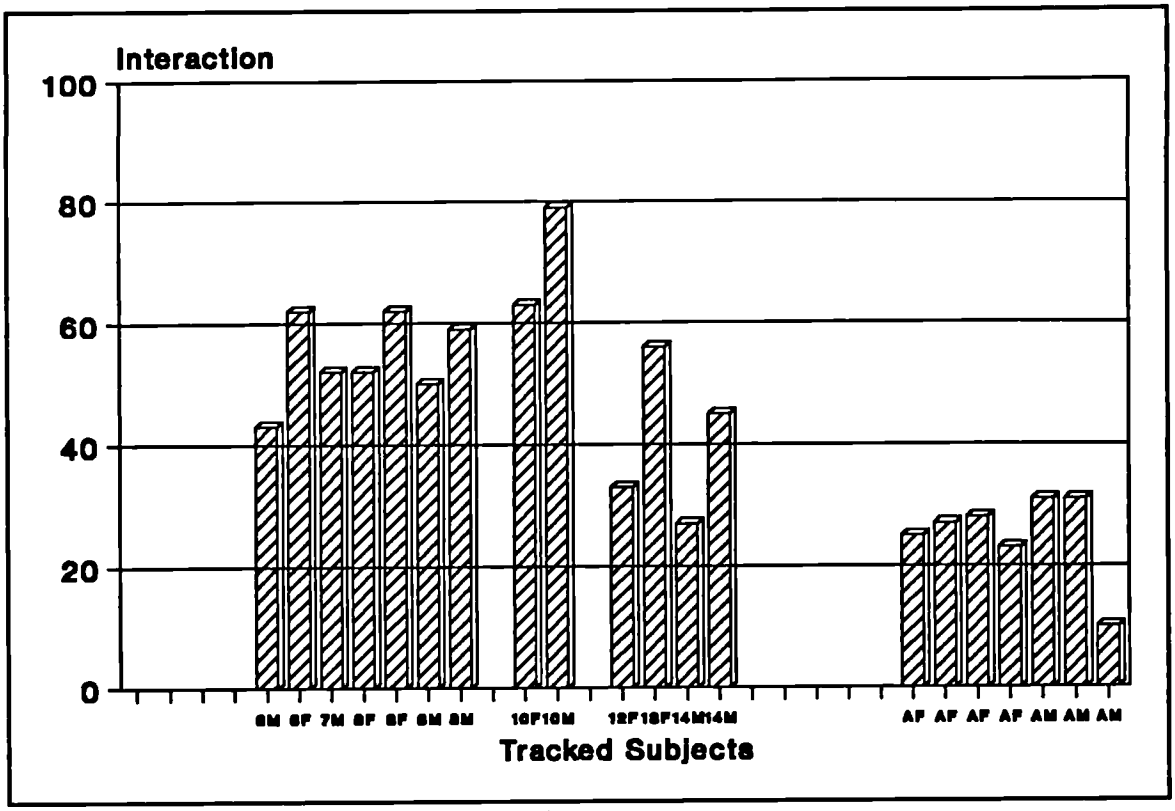

Figure 51 "Interaction" for each of the tracked subjects.

- females tend to show more variety in their choice of exhibits and therefore they pay attention for less than males
- males and females are equally *hands-on*.

5.3 Exhibits Data

This section concentrates on the individual exhibits in Launch Pad. Whilst tracking was in progress, 68 exhibits (including three demonstrations) were at some time in Launch Pad - although not all of them were there for all of the time. During collection of the tracking data and from casual observation it was apparent that the exhibits are very different from one to another. For example, some attract a lot of visitors, others do not. At some, visitors spend a lot time, others a short time. Various ways of classifying the exhibits were attempted in order to bring out some of the underlying patterns.

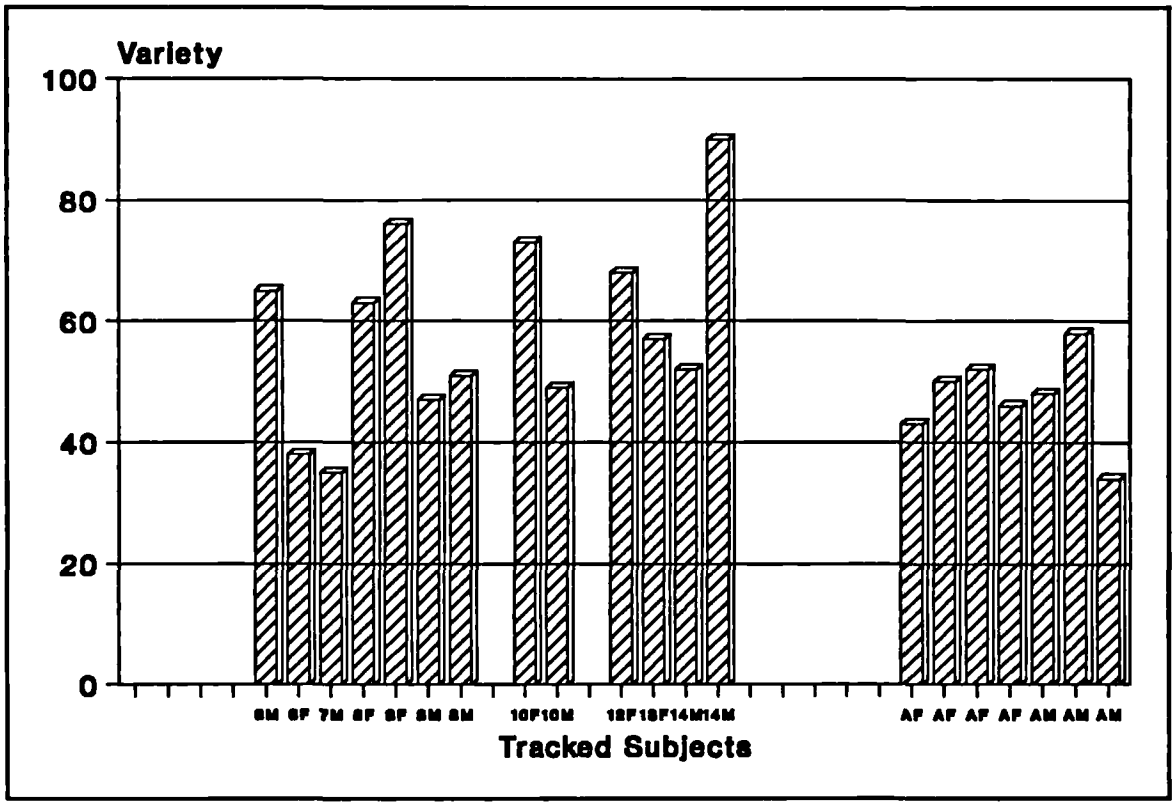

Figure 5m "Variety" for each of the tracked subjects.

The data were analysed to produce the amount of time each subject observed or interacted with each exhibit. This information is given in Table K-iii and Table K-iv. From these tables, the mean times which visitors observed and interacted with each of the exhibits were calculated and are shown in Table 5-ii and Table 5-iii respectively. There is a considerable variation in these times. The mean observed times range from 3 seconds (COLOUR BOX) to 9 minutes 12 seconds (ROCKET DEMO). As the demonstrations run for about 10 minutes these high times are not surprising, and the COLOUR BOX is an exhibit which one has to interact with by walking into it - there is nothing to observe from outside. However, exhibits such as GEAR WHEELS, COLOUR FILTER and LEANING TOWER all have mean observed times of 10 seconds or less thus indicating that they are not very attractive to watch. Apart from the demonstrations ROBOT 2, PULSE DETECTOR and TURNTABLE all have mean observed times of more than 100 seconds which indicate that visitors find it attractive watching other people use these exhibits.

The mean interacted times also show a wide variation although the distribution of times

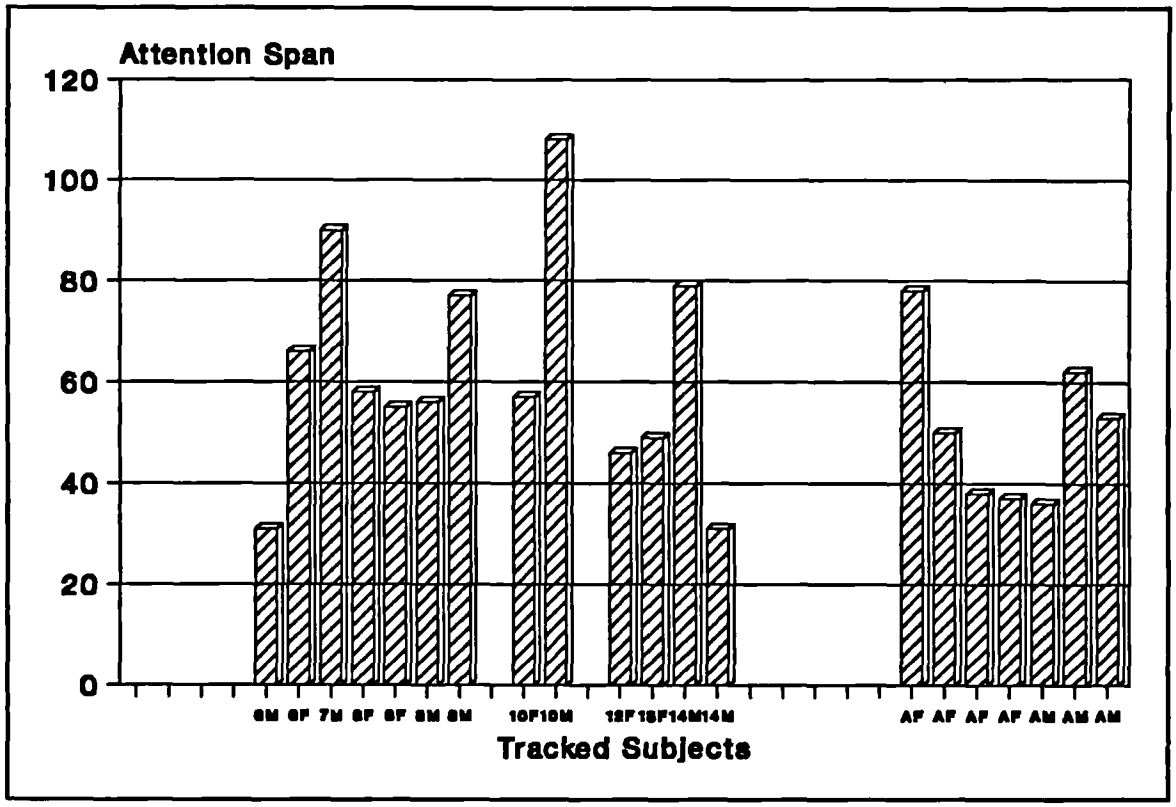

Figure 5n "Attention Span" for each of the tracked subjects.

Table 5-iv Mean, median, range and standard deviation of the exhibit observe and interact times.

	Observation	Interaction
	(seconds)	(seconds)
Mean	47	65
Median	20	40
Range	1 - 1273	1 - 1170
Standard Deviation	97	90
	n = 523	n = 501

is very different, Excluding the demonstrations, with which it is impossible to interact, the exhibits with the lowest times were TOUCH SCREEN (12 seconds) and AIR ENGINE (20 seconds). ROBOT 2 (342 seconds) and FLOW TANK (213 seconds) had the highest times. Interact times for the other exhibits are fairly evenly spread between these times, whereas the observe times were clumped between 10 and 50 seconds. The mean, median, range

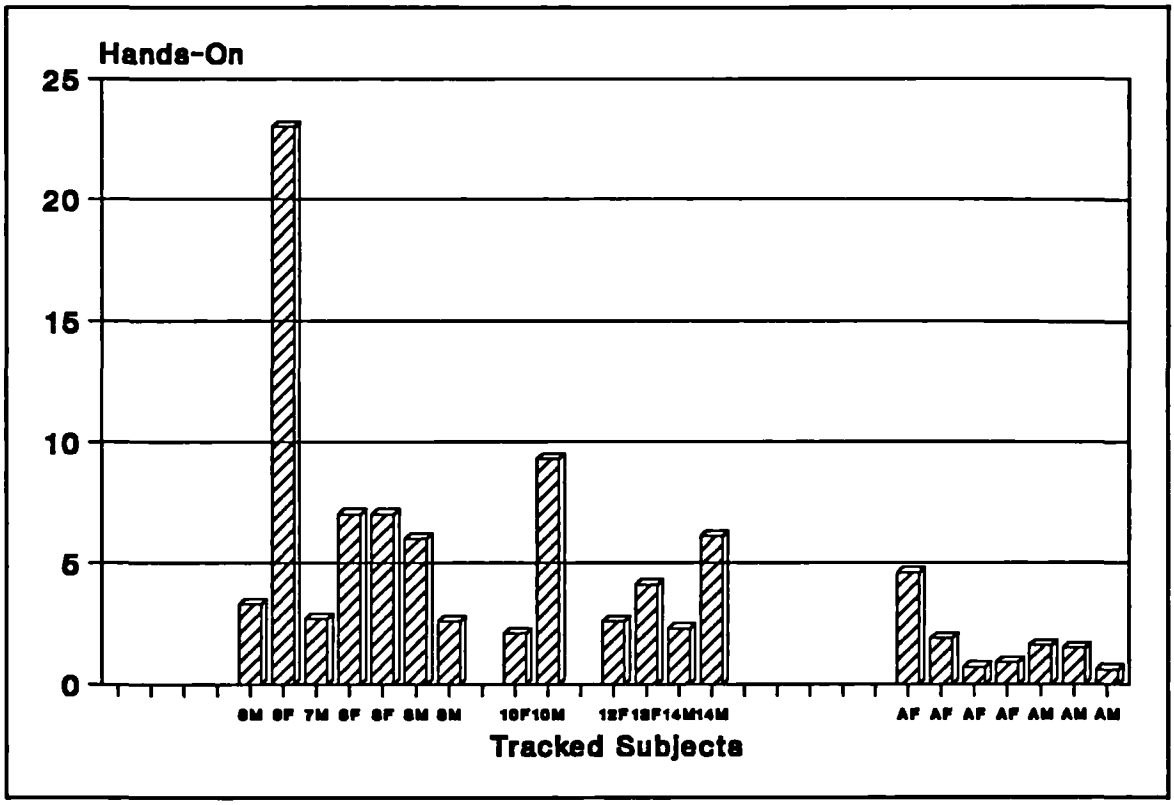

Figure 5o "Hands-on" for each of the tracked subjects.

and standard deviation of the observe and interact times are given in Table 5-iv.

Even casual observation of visitors' behaviour in Launch Pad shows that some exhibits are more popular that others, i.e. there are more visitors either observing or interacting with certain exhibits - the GRAIN PIT or TURNTABLE, seem to have more visitors than LOCK & KEY or STRING STRUCTURE for example. Therefore the indicator ***Overall Popularity*** was introduced as a measure of this effect. It is defined as:

$$\frac{(\textit{no of tracked subjects Attending to exhibit}) \times 100}{(\textit{no of times exhibit present})}$$

Attending has been defined as either observing or interacting with an exhibit. If all 20 tracked subjects had attended to one of the exhibits which was there for all of them then the exhibit would have an ***Overall Popularity*** of 100%. The ***Overall Popularity*** of the exhibits available for use by the tracked subjects is shown in Table 5-v. Four exhibits tie for top place: TURNTABLE, TIPTOE TESTER, GRAIN PIT and BEAMED VOICES.

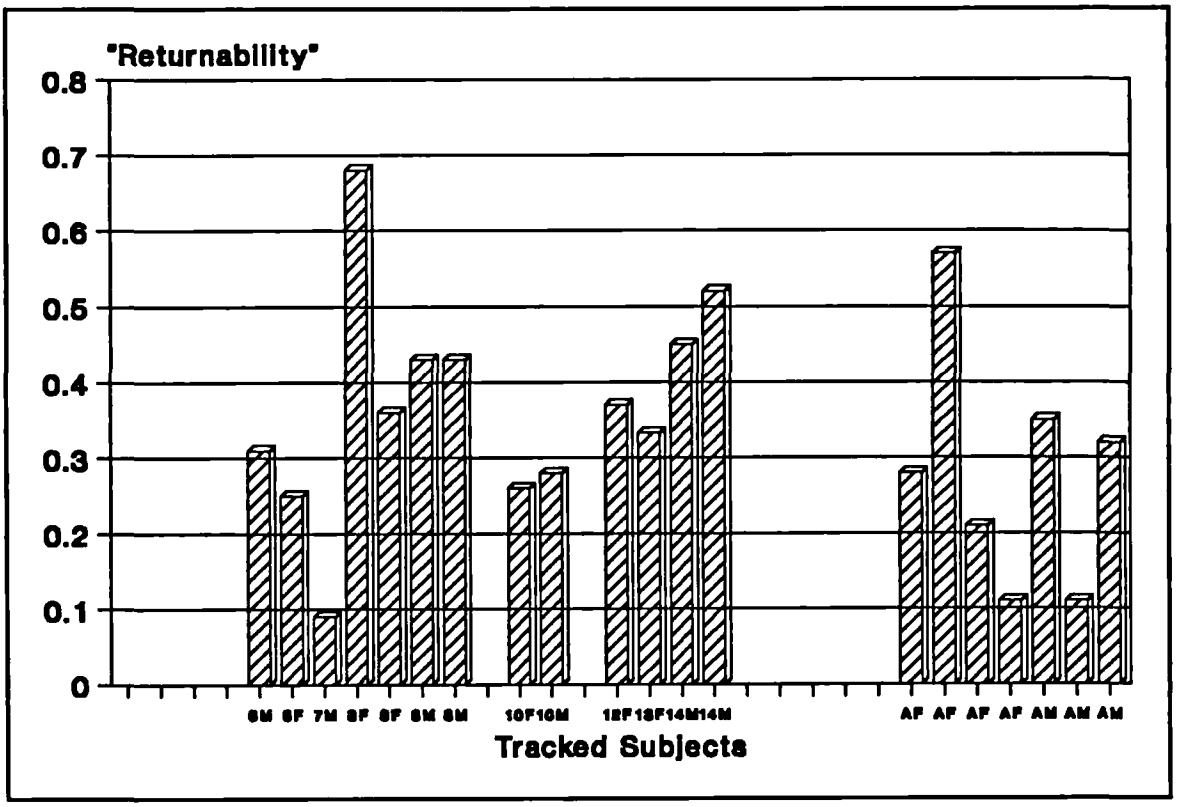

Figure 5p "Returnability" of the tracked subjects.

Observed Popularity and ***Interacted Popularity*** are defined in a similar way with the number of tracked subjects attending to the exhibit being replaced by the number observing or interacting with the exhibit respectively in the above formula. Within this broad definition of popularity there are big differences between the exhibits. If the exhibits are listed in the order of ***Observed Popularity***, and then of ***Interacted Popularity*** (see Table 5-vi and Table 5-vii), it can be seen that SLOW BUBBLES, for example, scores highly on ***Observed Popularity*** but has a below average ***Interacted Popularity***.

Each exhibit seems to have its own individual set of characteristics, or a character of its own. Exhibit Profiles were then drawn for each exhibit to try to represent this character in a graphical or pictorial form. Four sample Exhibit Profiles are shown here: TURNTABLE, GEAR WHEELS, ELECTRIC DUST, and STRING STRUCTURE). The vertical axis of an Exhibit Profile represents time in seconds. The time each subject spent observing or interacting with the exhibit is shown as a small black or white square respectively. If a subject both observed and interacted with the exhibit, then their observation and interaction times are joined

***Table 5-ii** Mean times for which exhibits were observed.*

Seconds	Exhibit	Seconds	Exhibit
552	Rocket Demo	34	Tipper Trucks
475	Paper Making Demo	32	Light Pipes
440	Bubble Demo	31	Hangover Problem
252	Robot 2	30	Gyro Wheel
131	Pulse Detector	29	Kaleidoscope, Electric Generator
105	Turntable	28	Pedal Power, Heavy Pen, Musical Trains
75	Finger Paint		
72	TipToe Tester	24	Salt Bowl, Stress Patterns
68	Giant Steelyard	23	Shake hands, Energy Store, Hot Hands
63	Crane	21	Laser Circles
60	TwoWay Mirror	20	Plasma Ball, Cartesian Diver, Magnetic River, String Structure
55	Touch Screen		
52	Slow Bubbles	19	Bearing Kit
51	Arch Bridge	17	Human Battery, Roller Run, Car Drag Test
47	Pump Kit, Heat Pictures		
46	River Bridge	16	TV & Magnet, Balancing Blocks
44	Flight Test, Beamed Voices	15	Electric Dust, Watch Dog, Air Engine
43	Air Jet, Puzzle Corner, Grain Pit, Flash Words	14	Look Here
		13	Big Optics
42	Electric Motor, Flow Tank	11	Pulleys & Belts, Hot or Cold
41	Bubble Sheet	10	Leaning Tower
40	Train Wheels	9	Colour Filter
39	Computer Video	8	Gear Wheels
37	Lock & Key	3	Colour Box

together with a line. The four sample Exhibit Profiles show marked differences from exhibit to exhibit. They give a clear indication of how popular an exhibit is, and how much time subjects are prepared to spend observing and interacting with it. Also, it is clear how many visitors both observe and interact with an exhibit.

The TURNTABLE (Figure 5q) is seen to be a popular exhibit with a large number of subjects observing but only a third of them then interacted with it. This exhibit has a relatively high mean observation time but a much lower mean interaction time. About half the subjects both observed and interacted with it. Casual observation suggests that visitors are prepared to queue in order to have a go on it.

GEAR WHEELS (Figure 5r) is very different, although it is almost as popular. Visitors do not find it very appealing to observe but they do spend more time interacting with it. The percentage of visitors both interacting and observing is about the same.

***Table 5-iii** Mean times for which exhibits were interacted with.*

Seconds	Exhibit	Seconds	Exhibit
342	Robot 2	55	Laser Circles, TwoWay Mirror
213	Flow Tank	54	Look Here, Arch Bridge
195	Grain Pit	52	Gear Wheels
189	Tipper Trucks	47	Plasma Ball, Balancing Blocks
185	Lock & Key	46	Leaning Tower
183	Crane	45	Gyro Wheel
148	String Structure	44	Magnetic River
119	Pulleys & Belts	43	Light Pipes
115	Energy Store	42	Roller Run, Shake Hands
107	Puzzle Corner	41	Stress Patterns, Beamed Voices
101	Electric Motor	40	Human Battery
96	Hangover Problem	39	Pump Kit, Pedal Power
88	Air Jet	37	Electric Generator, TipToe Tester
83	Finger Paint	35	Turntable
80	Flight Test	33	Kaleidoscope
78	Giant Steelyard	32	Colour Filter
73	Colour Box	31	Hot Hands, Musical Trains
72	Computer Video, Flash Words	28	Hot or Cold
71	Salt Bowl	27	Car Drag Test
67	Train Wheels	26	Electric Dust
64	Pulse Detector	24	Bearing Kit, TV & Magnet, Harmonic Drive
63	Cartesian Diver		
62	Heavy Pen	23	Watch Dog, Big Optics
61	Heat Pictures	20	Air Engine
58	Bubble Sheet	12	Touch Screen
57	Slow Bubbles	0	Bubble Demo, Paper Making Demo, Rocket Demo
56	River Bridge		

ELECTRIC DUST (Figure 5s) is seen to be not so popular as the TURNTABLE and GEAR WHEELS and its mean observation and interaction times are both low. However, the percentage of subjects both observing and interacting with it is higher than with the previous two exhibits.

STRING STRUCTURE (Figure 5t) is clearly not a popular exhibit. Only one subject interacted with it, although he did so for over two minutes. The five subjects who observed it, all for less than 40 seconds, did not feel compelled to interact with it.

Casual observation of visitors, and analysis of the data, suggest that another characteristic of an exhibit is the tendency for visitors, once they have observed it, to want to interact with it themselves. This is shown either by them waiting until the exhibit is free to

Table 5-v Overall "Popularity" of exhibits.

%	Exhibits
85	Turntable, TipToe Tester, Grain Pit, Beamed Voices
80	Shake Hands, Light Pipes, Hot or Cold
75	Kaleidoscope, Train Wheels, Energy Store
72	Slow Bubbles
70	Gear Wheels, Colour Box, Stress Patterns, Flow Tank
69	Robot 2
67	TwoWay Mirror, Rocket Demo
65	Air Jet, Roller Run, Plasma Ball, Salt Bowl, Computer Video
62	Pedal Power [average of Pedal Power 1, 2 & 3]
60	Puzzle Corner, Hot Hands, Gyro Wheel
58	Musical Trains
55	TV & Magnet, Watchdog, Flight Test, Look Here, Car Drag Test, Big Optics, Colour Filter
53	Harmonic Drive
50	Bubble Sheet, Arch Bridge, Electric Dust, Heat Pictures, Tipper Trucks, Laser Circles
45	Human Battery, Magnetic River, Bearing Kit
43	Bubble Demo
40	Cartesian Diver, Pulleys & Belts, Giant Steelyard, Leaning Tower, Flash Words, Heavy pen, Electric Generator, Crane, Paper Making Demo
35	Balancing Blocks, Air Engine
33	Electric Motor, Lock & Key, Pulse Detector
30	String Structure, River Bridge
25	Hangover Problem, Finger Paint
10	Pump Kit, Touch Screen

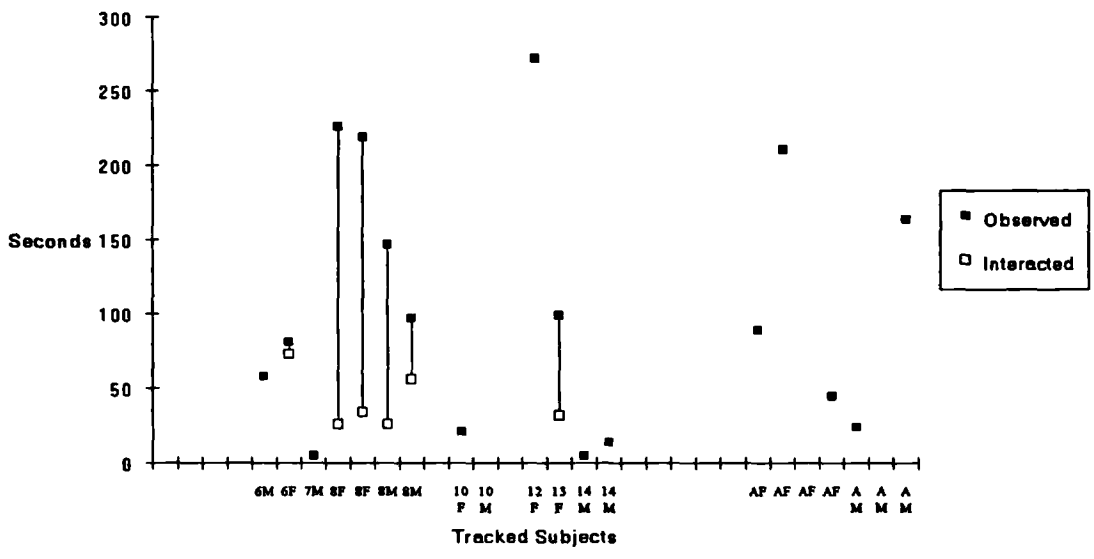

Figure 5q Exhibit Profile of the TURNTABLE.

interact with it themselves or else by coming back later when no-one else is using it.

***Table 5-vi** Observed "Popularity" of exhibits.*

%	Exhibit
90	Grain Pit
85	Turntable, TipToe Tester,
84	Pedal Power[average]
83	Slow Bubbles
75	Robot 2
70	Beamed Voices
67	Rocket Demo
65	Air Jet, Light Pipes, Computer Video
55	Plasma Ball, Salt Bowl, Stress Patterns, Flow Tank
50	Electric Dust, Train Wheels, Musical Trains, Laser Circles
47	Bubble Sheet
45	Shake Hands, Puzzle Corner, Watchdog, Kaleidoscope, Energy Store, Car Drag Test, Hot or Cold, Big Optics, Tipper Trucks
43	Bubble Demo
40	Gear Wheels, TV & Magnet, Magnetic River, Flight Test, Hot Hands, Crane, Paper Making Demo
38	Heavy Pen
35	Arch Bridge, Roller Run, Cartesian Diver, Flash Words, Gyro Wheel
33	Two Way Mirror, Lock & Key, Pulse Detector, Harmonic Drive
30	Human Battery, Pulleys & Belts, Giant Steelyard, Look Here, Bearing Kit
25	String Structure, River Bridge, Colour Filter, Finger Paint
21	Electric Motor
20	Electric Generator, Hangover Problem, Air Engine
19	Heat Pictures
15	Balancing Blocks, Leaning Tower
5	Pump Kit, Colour Box, Touch Screen

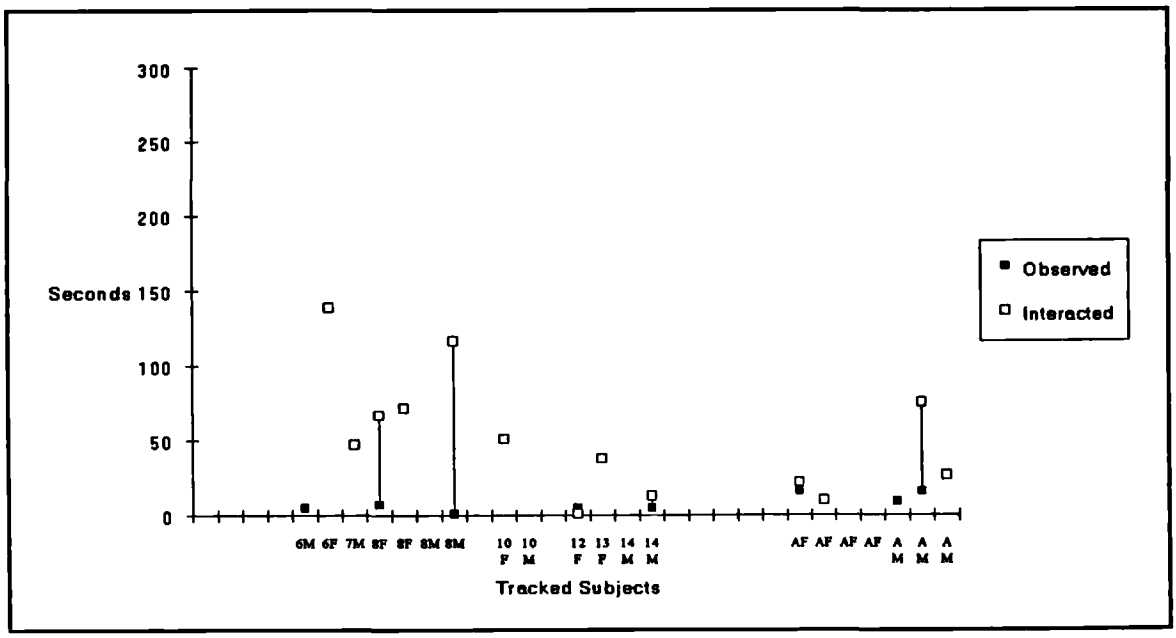

***Figure 5r** Exhibit Profile of GEAR WHEELS.*

***Table 5-vii** Interacted "Popularity" of exhibits.*

%	Exhibit
80	Beamed Voice
75	Shake Hands
71	Pedal Power[average]
70	Colour Box
65	Gear Wheels, Tip Toe Tester, Watchdog, Kaleidoscope, Hot or Cold
60	Light Pipes, Train Wheels, Salt Bowl, Look Here
55	Plasma Ball
50	Energy Store, Hot Hands, Stress Patterns, Heat Pictures
47	Harmonic Drive
45	Air Jet, Roller Run, Gyro Wheel, Flow Tank, Colour Filter, Laser Circles
44	Two Way Mirror
42	Musical Trains
40	Arch Bridge, Human Battery, Grain Pit, Flight Test, Car Drag Test, Electric Generator, Big Optics
38	Robot 2
36	Bubble Sheet
35	Turntable, Electric Dust, Leaning Tower, Computer Video, Bearing Kit,
33	Slow Bubbles
31	Heavy Pen
30	TV & Magnet, Giant Steelyard, Flash Words, Crane, Tipper Trucks
27	Pulse Detector
26	Electric Motor
25	River Bridge
20	Cartesian Diver, Magnetic River, Hangover Problem, Air Engine
18	Balancing Blocks
15	Pulleys & Belts, Finger Painting
11	Lock & Key
5	Pump Kit, Touch Screen, String Structure
0	Rocket Demo, Bubble Demo, Paper Making Demo

This characteristic, termed ***Follow-Up*** (see Table 5-viii.), is defined as:

$$\frac{(\textit{no both observing \& interacting with exhibit}) \times 100}{(\textit{no of subjects who attended to exhibit})}$$

The exhibits with the highest ***Follow-Up*** are PULSE DETECTOR, LASER CIRCLES, TIPTOE TESTER and the CRANE, and those with the lowest are PUMP KIT, TOUCH SCREEN and STRING STRUCTURE.

Following a study of all the exhibit profiles I decided to take the following four characteristics as a way of sorting the exhibits: overall ***Popularity***, mean observation time, mean interaction time and ***Follow-Up***. Each exhibit was given a high, average or low rating for each of the four characteristics. A high rating was given to all exhibits in

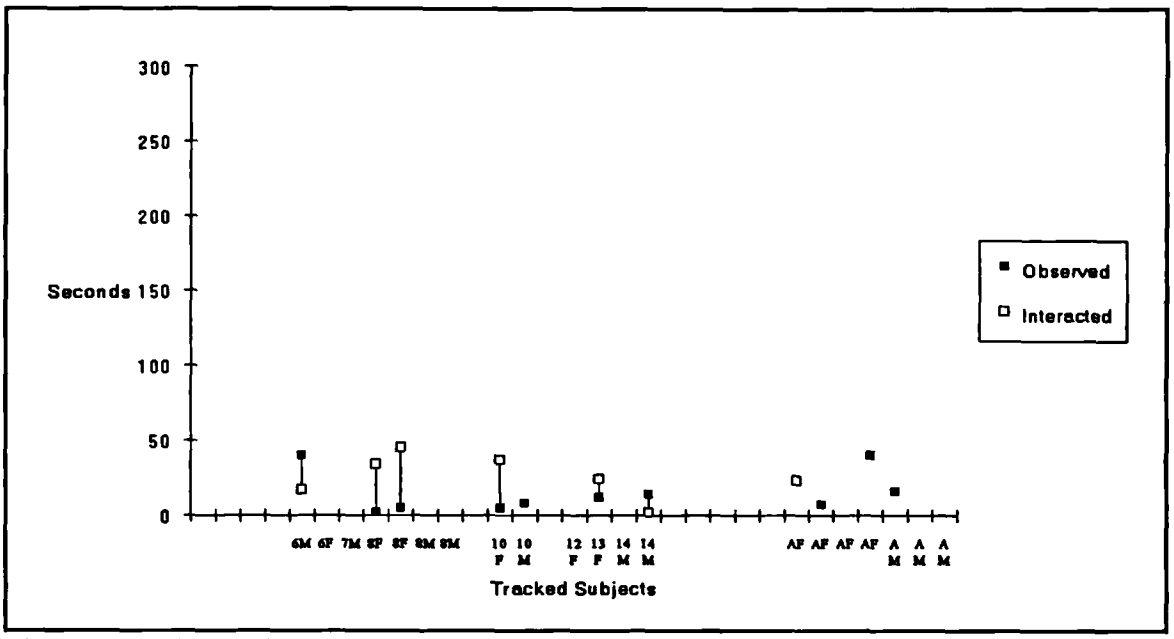

Figure 5s Exhibit Profile of ELECTRIC DUST.

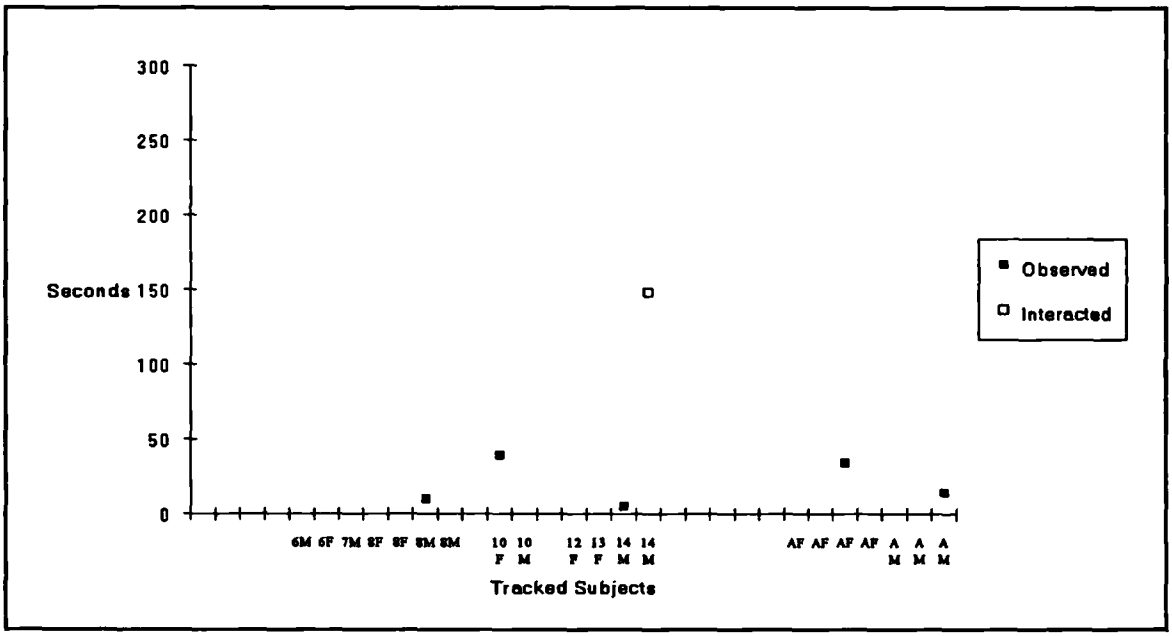

Figure 5t Exhibit Profile of STRING STRUCTURE.

the upper quartile of the range of each characteristic, and a low rating to all those in the lower quartile. All other exhibits received an average rating. Each exhibit was then plotted on a chart (see Figure 5u) to show its essential characteristics and its relationships with other exhibits. On this chart, the observation time is plotted on the x-axis and the interaction time is plotted on the y-axis. Within each main section (bounded by the heavy lines), ***Popularity*** is plotted on the x-axis and ***Follow-Up*** is plotted on the y-axis.

***Table 5-viii** "Follow-Up" of the exhibits.*

	Exhibit
.50	Pulse Detector, Laser Circles
.76	TipToe Tester
.75	Crane
.71	Bubble Sheet, Beamed Voices
.69	Salt Bowl
.67	Puzzle Corner, Heavy Pen
.64	Watch Dog, Flight Test
.62	Air Jet
.60	Electric Dust, Hangover Problem
.57	Musical Trains
.56	Light Pipes
.55	Look Here, Car Drag Test, Robot 2
.53	Kaleidoscope
.50	Giant Steelyard, Stress Patterns, Electric Generator, Harmonic Drive
.47	Train Wheels, Grain Pit
.46	Plasma Ball, Slow Bubbles
.44	Shake Hands, Human Battery
.43	Flow Tank
.42	Hot Hands
.41	Turntable
.40	Arch Bridge, Finger Paint
.38	Cartesian Diver, Leaning Tower, Flash Words, Hot or Cold, Heat Pictures
.36	Gear Wheels, Big Optics
.33	Two Way Mirror, Magnetic River, Electric Motor, Lock & Key, Gyro Wheel, River Bridge
.30	Tipper Trucks
.29	Balancing Blocks
.27	Energy Store, Colour Filter
.25	Pulleys & Belts
.23	Roller Run
.18	TV & Magnet
.14	Air Engine
.11	Bearing Kit
.07	Colour Box
.00	Pump Kit, Touch Screen, String Structure, Rocket Demo, Bubble Demo, Paper Making Demo

Only one exhibit, AIR ENGINE, received a low rating on each of the four characteristics, and no exhibit scored highly on all four. It is interesting to note that the exhibits are scattered on the chart, showing that *scoring* highly on one characteristic does not automatically mean that it scores highly on the others. The exhibits in Launch Pad have therefore various *characters* which ensure that they appeal to a wide range of visitors.

One characteristic of exhibits which has not yet been analysed here is their ability to

Note: On this chart, the average time which subjects observed each exhibit is plotted on the x-axis, and the average time spent interacting with it is plotted on the y-axis.

Within each of the nine main sections of the chart (bounded by the heavy lines), ***Popularity*** is plotted on the x-axis and ***Follow-Up*** is plotted on the y-axis.

		LOW OBSERVATION			AVERAGE OBSERVATION			HIGH OBSERVATION	
		Puzzle Corner		Hangover Problem	Air Jet Flight Test		Crane		
HIGH INTERACTION				Electric Motor Lock & Key		Grain Pit Flow Tank	Giant Steelyard Finger Paint	Robot 2	
	Pulleys & Belts		Colour Box	String Structure	Tipper Trucks	Energy Store			
				Heavy Pen	Bubble Sheet Salt Bowl Laser Circles	Light Pipes Pedal Power Beamed Voices	Pulse Detector		TipToe Tester
AVERAGE INTERACTION	Leaning Tower	Human Battery Look Here	Gear Wheels	Cartesian Diver Flash Words Electric Gen'tor	Plasma Ball, Gyro Wheel Magnetic River Computer Video	Shake Hands Train Wheels Stress Patterns	River Bridge	Arch Bridge TwoWay Mirror Heat Pictures	Turntable Slow Bubbles
	Balancing Blocks	Roller Run					Pump Kit		
		Electric Dust Watchdog			Musical Trains				
LOW INTERACTION		Car Drag Test Harmonic Drive	Hot or Cold		Hot Hands Big Optics	Kaleidoscope			
	Air Engine	TV & Magnet Colour Filter			Bearing Kit		Touch Screen PaperMaking Demo	Rocket Demo Bubble Demo	

Figure 5u Chart showing the essential characteristics of the exhibits.

attract visitors back for a second or third time. ***Return Appeal*** is therefore defined as:

$$\frac{(no\ of\ times\ exhibit\ visited)}{(no\ of\ subjects\ who\ visited)} - 1$$

If no-one was encouraged to return to an exhibit then its ***Return Appeal*** would be zero (e.g. PUMP KIT, TV & MAGNET, PULLEYS & BELTS, TOUCH SCREEN, HEAT PICTURES and COLOUR FILTER). The exhibit with the highest ***Return Appeal*** of 1.00 is ROBOT 2; i.e. on average every visitor returns to that exhibit once (in reality, two subjects made 3 visits and one 14 year old

Table 5-ix *"Return Appeal" of all the exhibits.*

	Exhibit
1.00	Robot 2
0.92	Air Jet
0.76	TipToe Tester
0.71	Turntable, Grain Pit, Musical Trains
0.63	Crane
0.60	Pulse Detector
0.57	Balancing Blocks, Stress Patterns
0.55	Flight Test
0.53	Beamed Voices
0.50	Electric Generator, River Bridge
0.47	Kaleidoscope
0.43	Bubble Sheet, Flow Tank
0.42	Gyro Wheel
0.40	Hangover Problem, Finger paint
0.38	Slow Bubbles, Giant Steelyard
0.36	Watch Dog, Big Optics, Pedal Power
0.33	Train Wheels, Lock & Key, String Structure, Heavy pen
0.31	Light Pipes, Salt Bowl
0.30	Electric Dust
0.27	Look Here, Car Drag Test
0.25	Harmonic Drive
0.23	Plasma Ball
0.20	Arch Bridge, Energy Store, Tipper Trucks, Laser Circles
0.17	Electric Motor, Hot Hands
0.14	Colour Box, Air Engine
0.13	Shake Hands, Cartesian Divers, leaning Tower, Flash Words
0.11	Human Battery, Magnetic River, Bearing kit
0.08	Roller Run, Computer Video
0.07	Gear Wheels
0.06	Hot or Cold
0.00	Pump Kit, TV & Magnet, Pulleys & Belts, Touch Screen, Heat Pictures,Colour Filter, Rocket Demo, Bubble Demo, Paper Making Demo

male made 5 visits. The ***Return Appeal*** of all the exhibits is given in Table 5-ix, which shows that the values are evenly distributed.

5.4 Conclusion

The most striking conclusion to be drawn from the tracking data is that Launch Pad does hold the attention of its visitors. Visitors attend to the exhibits for longer than when in a normal museum (Diamond 1986 and Hilke 1989), and visitors are not inclined to *museum fatigue*. Rushing around or flitting from exhibit to exhibit was not observed; the behaviour of visitors was purposeful and directed towards the exhibits.

There are many differences between the exhibits and between the tracked subjects themselves which have been identified and analysed in this chapter. Although some exhibits are clearly more popular than others, every exhibit was both observed and interacted with by at least one of the 20 tracked subjects. The analysis has shown that exhibits have several characteristics and the data suggest that there is no perfect or ideal exhibit which will appeal to everybody. This variety of exhibits is probably one of the reasons for Launch Pad's success.

Several indicators, such as ***General Involvement***, ***Interactivity***, ***Overall Popularity*** and ***Return Appeal***, have been introduced and defined in order to be able to quantify, and therefore compare, the differences that exist between interactive exhibits and visitors' behaviours at these exhibits. The indicators which have been defined in this thesis will enable comparisons to be made between studies at differing ISTCs. The concept of Exhibit Profiles has been introduced as a way of easily and graphically representing the differences between interactive exhibits. Also, a chart showing the essential characteristics of interactive exhibits has been devised.

The tracking data will provide useful background information when analysing the results of the Post-Visit Interviews, Follow-Up Questionnaires and Follow-Up Interviews.

CHAPTER 6 POST-VISIT INTERVIEWS

6.1 Introduction

The Post-Visit Interviews (PVIs) were designed to collect the first impressions of visitors immediately after their visit to Launch Pad, and to provide information for the development of the Follow-Up Interview (FUI). Also, those given a PVI formed a pool from which those given a FUI were selected. All those who agreed were sent a Follow-Up Questionnaire.

As described in section 4.3, 396 visitors in 109 groups were given a PVI. The numbers of males and females interviewed were approximately the same, and slightly more children than adults were interviewed.

The results of the PVI are described in the order in which the questions were asked. A copy of the PVI question sheet is given in Appendix E, and the responses to the questions are given in Table L-i to Table L-xiii in Appendix L.

6.2 General Questions

The responses to the question "Have you enjoyed your visit to Launch Pad?" were overwhelmingly enthusiastic as Figure 6a indicates. The subjects who gave a positive yes (98.4%) to the question would often add comments such as "excellent", "very much" and "definitely". Five subjects, mostly adult females, gave ambivalent answers such as "It's mainly for children." [AF][3], "I suppose so." [12F], and "not an emphatic yes" [AM], . Only one subject, a four year old boy, said that he had not enjoyed Launch Pad, but in

[3] See key in Appendix I on page 267 for explanation of codes.

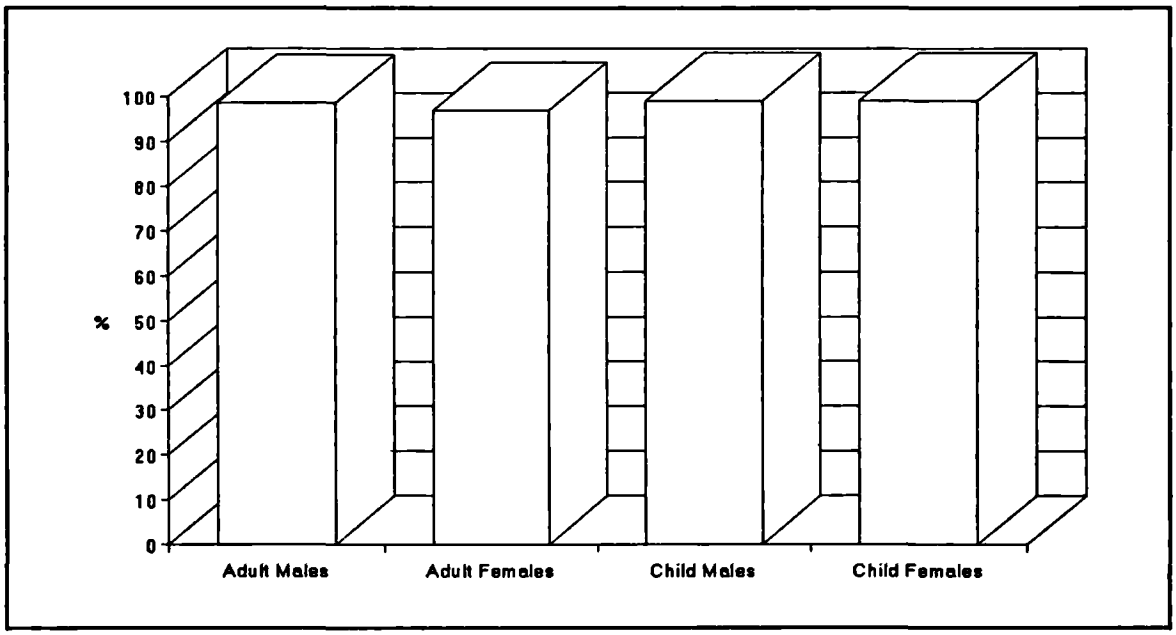

***Figure 6a** Percentage of those replying positively to the PVI question: "Have you enjoyed your visit?".*

the light of the enthusiasm he showed when answering the rest of the questions I suggest that he was not being completely serious.

Although groups varied in the length of time they said they spent in Launch Pad from about 10 minutes to over 3 hours, nearly half of the groups thought they had spent just

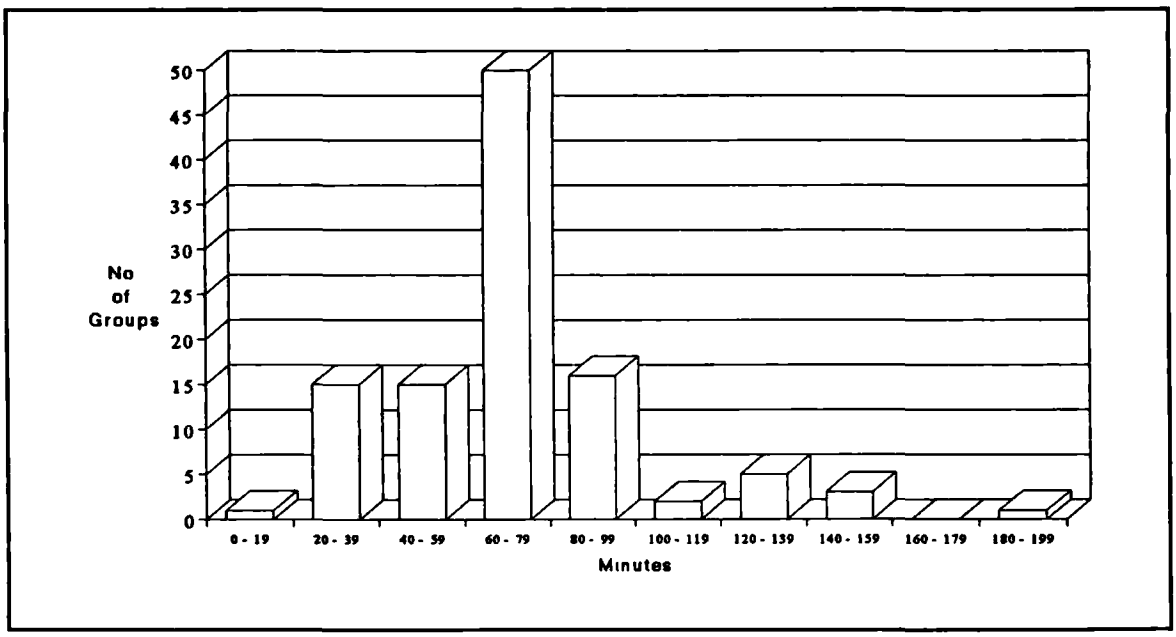

***Figure 6b** Times which PVI groups stated that they had spent in Launch Pad.*

over an hour in Launch Pad as shown in Figure 6b. Posing of this question generated a fair amount of discussion amongst the members of each group, as there were wide differences of opinion as to the actual time spent in Launch Pad. This finding reflects Brewer's (1988) results described on page 64 that personal memories rarely contain much information about time - even immediately after the event.

It is possible to compare the accuracy of 17 of the overall times with those obtained in the tracking data in Chapter 5. Table L-ii in Appendix L shows for each tracked group the actual time spent in Launch Pad compared with the reported time given together with the percentage error. This data is represented graphically in Figure 6c. Most groups

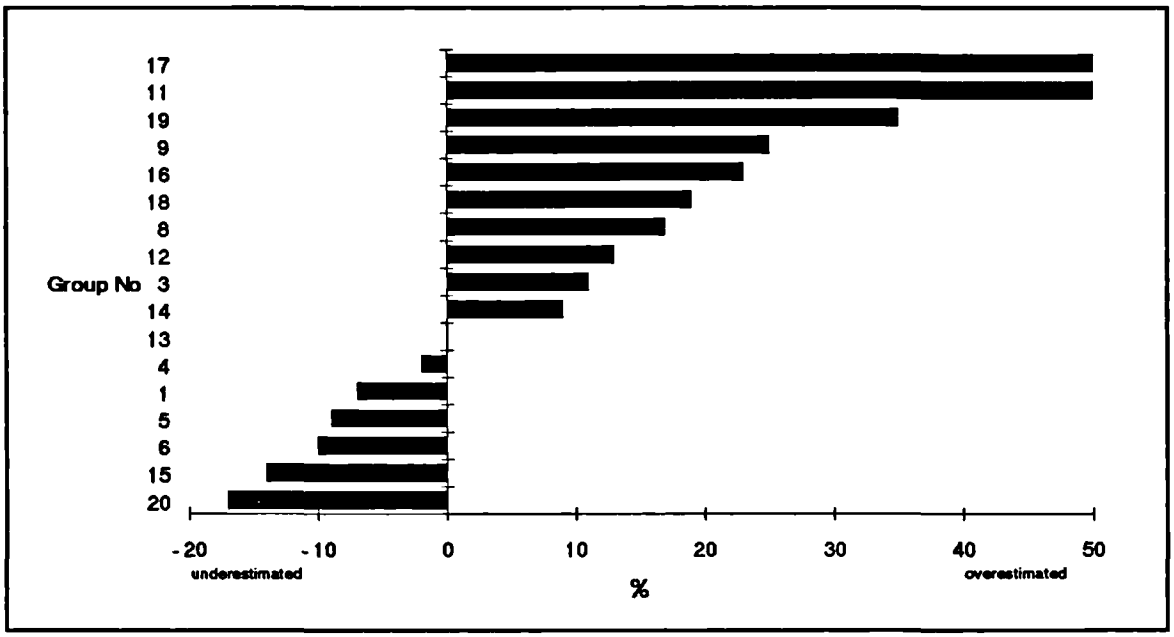

Figure 6c Percentage error of the length of time which groups either over- or under-estimated they had spent in Launch Pad.

tended to overestimate the time they had spent in Launch Pad, some by up to 50%, although other groups under-estimated by as much as 14%.

For three quarters of those interviewed it was their first visit to Launch Pad. Fifteen percent had visited once before, and 6% had visited twice before (see Table L-iii on page 285). The remaining 4% had visited Launch Pad three or more times previously. Several

people volunteered the information that they had come on the recommendation of another member of the group who had either visited as part of a school party or with other people. Towards the end of the period during which the PVIs were conducted, more people replied that they had visited previously. This may indicate that if the interviews were conducted now a higher proportion of visitors would be on a return visit.

The last of the general questions asked subjects to compare what Launch Pad offered to that of museums. The intention of the question was to get an indication of how visitors rated a visit to Launch Pad compared to a normal museum visit; if they had the choice what would they choose. This is how the vast majority of subjects saw it, and was articulated by the adult male in group 57 in the following way:

> AM: It must be (a). I offered to take them to a museum and they said no - we'll go to Launch Pad. [PVI57]

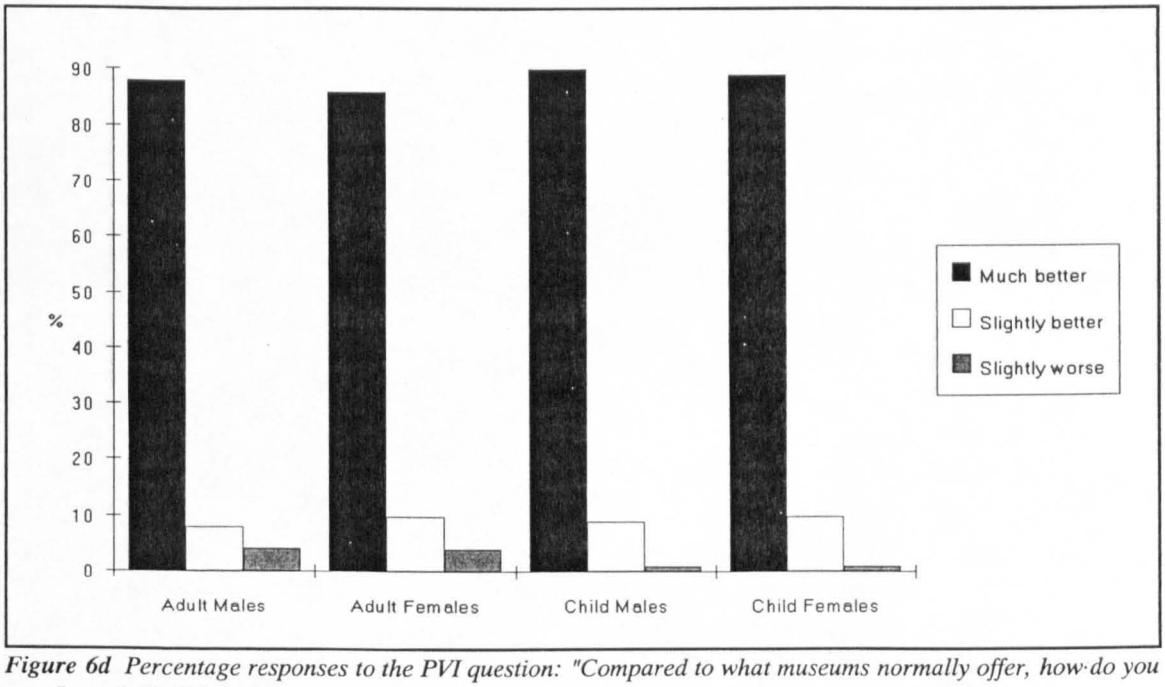

Figure 6d *Percentage responses to the PVI question: "Compared to what museums normally offer, how do you rate Launch Pad?"*

However, several subjects remarked that they were being asked to compare two dissimilar things. As Figure 6d shows, 97.6% of those answering thought that Launch Pad compared to what museums normally offer, was slightly or much better. A small number of adults preferred a more traditional museum, and some adults who gave a (b) rating for themselves, stated that for children it should be rated an (a).

6.3 Exhibit Questions

The central part of the PVI is the question "Which exhibit impressed you most?". Out of a possible 73 exhibits that could have been mentioned, the 388 subjects mentioned 57 (i.e 78%) of them - see Table L-v. Not all of these exhibits were available for every subject, so this does show very clearly the differing appeals of the exhibits in Launch Pad, and is a gratifying result for the originators and developers of the exhibits.

The TURNTABLE was present for all 388 subjects who answered the question whereas the TWOWAY MIRROR and TV AERIAL were there for only 190 and 109 subjects respectively. In order to take account of the varying opportunities which visitors had to see certain exhibits, the indicator ***Impressiveness*** will be introduced. Similar to the indicator ***Overall Popularity*** for the tracking data which was introduced on page 106, ***Impressiveness*** is defined as:

$$\frac{(\textit{no of PVI subjects selecting exhibit}) \times 100}{(\textit{no of times exhibit present})}$$

The ***Impressiveness*** of each of the exhibits for the PVI subjects is shown in Table 6-i. BEAMED VOICES is the clear winner with an Impressiveness of 10.6%, well in front of PLASMA BALL, GRAIN PIT, PEDAL POWER and ROBOT 1. TURNTABLE and SHAKE HANDS are also close to the top. There were fifteen exhibits that were not mentioned by anybody. Of these, GEAR WHEELS, PULLEYS & BELTS, LEANING TOWER, MAGNETIC RIVER, HOT HANDS, BEARING KIT and AIR ENGINE were in Launch Pad when every subject visited and therefore had the maximum opportunity to impress, but unfortunately failed to do so. Out of a possible 75 exhibits, 60 (80%) impressed at least one person.

For comparison, the data was sorted according to the order of ***Impressiveness*** for adult males, adult females, child males and child females - see Table L-vi to Table L-ix in Appendix L. The data in these tables seem to suggest that exhibits can impress adults and children differently, and that certain exhibits can appeal to males and females in a

Table 6-i The "Impressiveness" of each of the exhibits for the PVI subjects.

Ex No	Exhibit Name	Impressiveness	Ex No	Exhibit Name	Impressiveness
66	Beamed Voices	10.6	111	River Bridge	0.8
88	Robot 1	7.9	119	Tipper Trucks	0.8
15	Plasma Ball	7.4	69	Touch Screen	0.7
41	Grain Pit	7.2	73	Lock & Key	0.7
1	Turntable	5.4	94	Pulse Detector	0.7
75	Water Sculpture	5.4	89	Heavy Pen	0.6
44	Pedal Power	5.2	28	Cartesian Diver	0.6
4	Shake Hands	4.6	9	Human Battery	0.5
24	Kaleidoscope	3.9	86	Gyro Wheel	0.5
71	Computer Video	3.9	92	Electric Generator	0.5
100	Robot 2	3.6	108	Musical Trains	0.4
21	TipToe Tester	3.1	130	Harmonic Drive	0.4
138	Bubble Demo	2.9	10	Roller Run	0.3
25	Slow Bubbles	2.7	49	Electric Motor	0.3
2	Air Jet	2.6	13	TV & Magnet	0.3
59	Colour Box	2.6	31	Giant Steelyard	0.3
45	Energy Store	2.4	39	Balancing Blocks	0.3
109	Flow Tank	2.4	60	Car Drag Test	0.3
19	Teach the Turtle	2.2	84	Stress Patterns	0.3
127	Finger Paint	2.1	99	Hot or Cold	0.3
32	Train Wheels	2.1	113	Big Optics	0.3
106	Hangover Problem	2.1	150	Information	0.3
112	Heat Pictures	1.9	8	Gear Wheels	0.0
55	Flight Test	1.8	27	Magnetic Pull	0.0
7	Arch Bridge	1.5	30	Pulleys & Belts	0.0
17	Puzzle Corner	1.5	33	TwoWay Mirror	0.0
107	Crane	1.5	37	Inverting Pendulum	0.0
11	Pump Kit	1.5	40	Leaning Tower	0.0
38	Salt Bowl	1.5	48	Magnetic River	0.0
6	Bubble Sheet	1.4	67	TV Aerial	0.0
118	Visible Air	1.1	82	Hot Hands	0.0
23	Watchdog	1.0	85	Bearing Kit	0.0
58	Look Here	1.0	96	Sounds Flat	0.0
140	Laser Circles	1.0	115	Air Engine	0.0
12	Electric Dust	0.8	122	Colour Filter	0.0
26	Light Pipes	0.8	136	Papermaking Demo	0.0
68	Flash Words	0.8	137	Rocket Demo	0.0
83	String Structure	0.8		none	0.0

different way. For example, ROBOT 1 impressed 19 boys and no girls; the difference between adults was not so marked however as it impressed 6 male and 4 female adults.

Adult females were most impressed jointly by TEACH THE TURTLE (which curiously impressed no other category) and SHAKE HANDS. They also found the HANGOVER PROBLEM impressive (and so did just one other - an adult male) and the PLASMA BALL (a favourite with all categories).

For adult males the WATER SCULPTURE was clearly the most impressive exhibit with a rating of 17%. They were next most impressed by BEAMED VOICES (12%) and PLASMA BALL (10%) - two exhibits most categories found impressive. This is followed by HEAT PICTURES (7%) which impressed only two other people. Some exhibits which impressed other groups, such as the GRAIN PIT, PEDAL POWER, TURNTABLE and FINGER PAINT failed to impress adult males.

Children were impressed by a smaller number of exhibits than adults. Boys and girls were impressed by 28 and 33 exhibits respectively, compared with adult males and females who were impressed by 37 and 40 exhibits respectively. The ROBOTS were particularly impressive for boys - ROBOT 1 receiving a rating of 19%. ROBOT 1 impressed no girls however, showing a startling gender difference in this instance. They were completely unimpressed by WATER SCULPTURE and ENERGY STORE which impressed other groups. The most impressive exhibit for girls was the TURNTABLE with a rating of 13%. Other impressive exhibits for girls were BEAMED VOICES (9%), PLASMA BALL (8%), and WATER SCULPTURE (8%).

As mentioned previously, the purpose of the question "What about it impressed you?" was to get an idea of the kinds of things visitors talked about in order to formulate and structure a more appropriate Follow-Up Interview. An analysis of the comments about exhibits made in the FUIs is given in section 8.3 on page 185. The network for coding exhibit memories (see Figure 8b on page 185) was developed after the PVIs had been completed. If the PVIs had been tape-recorded and transcribed a similar analysis could have been attempted, although my personal opinion is that the PVI would have to be more structured for this detailed analysis to be productive. However, a simple analysis of the responses will be made.

At the end of section 2.2 on Professional Views about ISTCs, it appeared that there were some general questions which needed answers (see page 34). These questions are concerned with what happens during a visit, thinking and emotional reactions. These three broad aspects of descriptions, thoughts and feelings, will be developed further in section 8.4 on page 189. The responses to the PVI question "What about it impressed

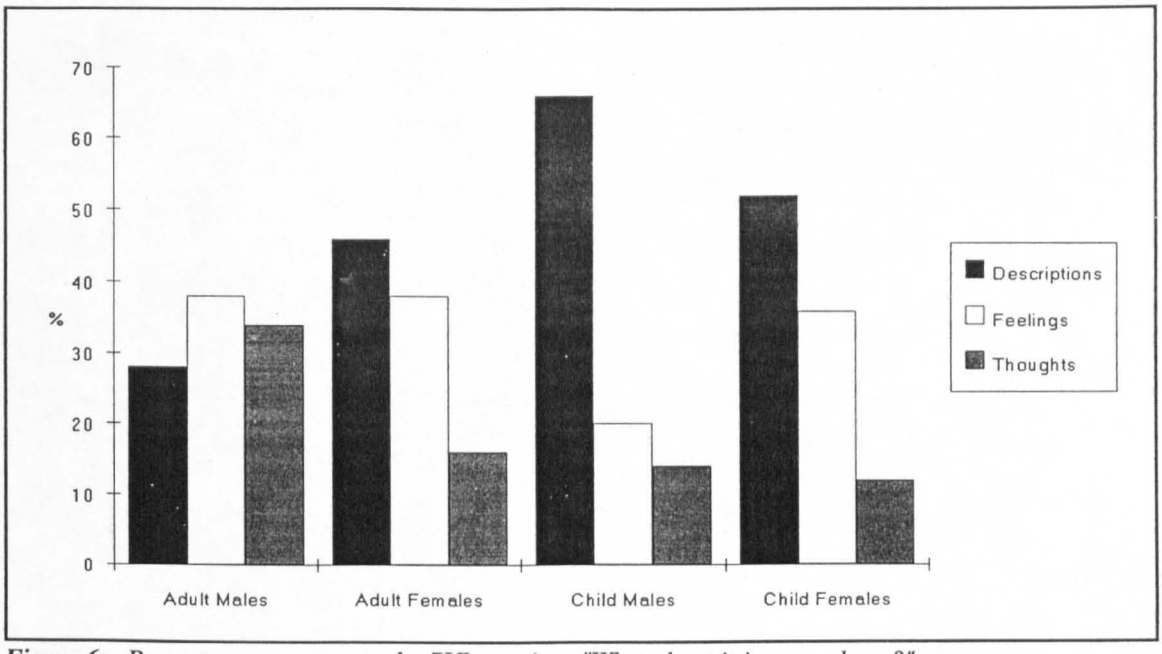

Figure 6e *Percentage responses to the PVI question: "What about it impressed you?".*

you?" can be analysed simply by placing them in one of three categories as to whether they are mainly concerned with describing what happened, how they felt about the exhibit or what thoughts they had about it. Figure 6e shows the results of this analysis.

Nearly half of the responses were concerned with describing what had happened. For example, an eight year old boy described the "hand thing" (SHAKE HANDS):

> 8M: You put your hand in and another hand appeared, and would shake hands. [PVI63]

The WATCHDOG exhibit impressed an eleven year old girl because of:

> 11F: How it picked up where you were moving about and growled. When you got closer, it got louder. The further away out of its way it stopped. [PVI58]

Many of the responses categorised as feelings (32.3%) were often fairly short:

> 7M: Just liked it. [PVI62: TRAIN WHEELS]

> 11F: Don't really know - liked them all really. I enjoyed it. [PVI68: FLOW TANK]

> AF: It was a shock. [PVI37: SHAKE HANDS]

10F: Just like it - just fun. [PVI49]

Eighteen per cent of the responses were categorised as thoughts. For example:

AM: I learned something. Presumably if one understands the rest you know what to expect. I never realised what the principle was. I didn't actually appreciate it would feel hot or cold. [PVI57: HOT OR COLD]

A thirteen year old boy said that he had learned how to counterweight in order to do the "impossible" on the RIVER BRIDGE puzzle. This was also categorised as a thought. [13M/PVI40]

As expected, children provided more descriptions than adults and therefore correspondingly fewer feelings and thoughts. Adult males responded in a markedly different way as their comments included twice as many thoughts as any other group.

When asked whether the exhibit which had impressed them reminded them of other

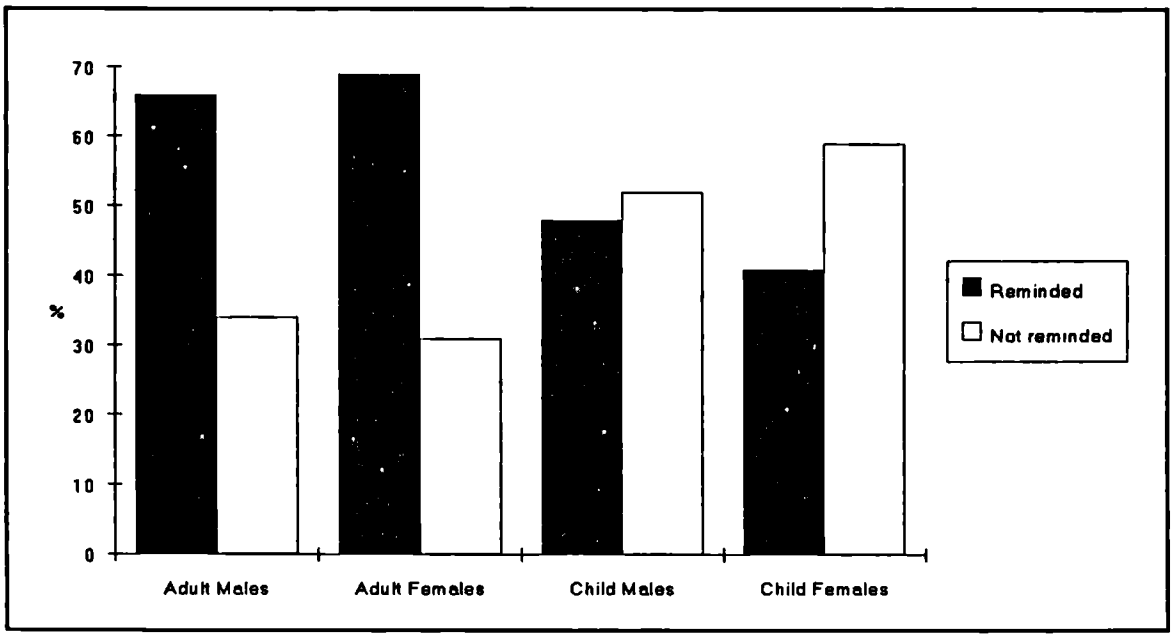

Figure 6f Percentage responses to the PVI question: "What other things did it remind you of?".

things, 55% of those responding (n=303) said yes - see Figure 6f. Many of the things of which visitors were reminded seemed fairly predictable. For example, the COLOUR BOX reminded visitors of a rainbow, a kaleidoscope and marbles, and the FLOW TANK reminded

an adult female of playing in streams as a child. This visitor was also reminded of all the best things that had happened in science at school. Several visitors were reminded of Jodrell Bank by the exhibit BEAMED VOICES. Other remindings were not immediately so obvious. For example, the GRAIN PIT exhibit reminded one adult female of the new machine to dig the Channel Tunnel (I believe it was the Archimedes screw part of this exhibit which prompted this memory).

Sometimes the exhibit which impressed a visitor reminded them of something which could not be accurately recalled (a tip of the tongue experience). One adult male, for example, said concerning the WATCHDOG exhibit:

> AM: Something - but I can't quite remember. At the back of my mind there's something I've seen a long time. [PVI51]

Similarly, the SHAKE HANDS exhibit reminded an adult female of a childhood memory:

> AF: It was something - must have been when I was a child. Can't remember what it was. I remember seeing something similar to that. So it brought back a funny memory of years and years ago. [PVI59]

The WATER PUMP exhibit which involves taking apart, assembling and then operating a simple pump reminded one visitor of:

> AF: Repairing my sewing machine and not getting it to work. [PVI71]

Here, it was the process that the visitor had used which reminded them of something rather than the exhibit itself. One adult male who had been impressed by the HOT & COLD exhibit said at first he had not been reminded of anything but he then went on to indicate that he had in fact been reminded of something that had puzzled him whilst working in a steel works:

> AM: Not particularly - other than working in a steel works and treating cold steel and wondering why it was so very cold and the rest of it wasn't. It was just a little part of science I never appreciated before. [PVI57]

For this visitor, Launch Pad had eventually provided him with a solution to something had puzzled him for several years. Through the HOT & COLD exhibit he had made the necessary links in his mind and learned some science, or rather come to understand properly some science he was aware of but had not fully appreciated.

When asked whether they had learned anything from the exhibit which had impressed

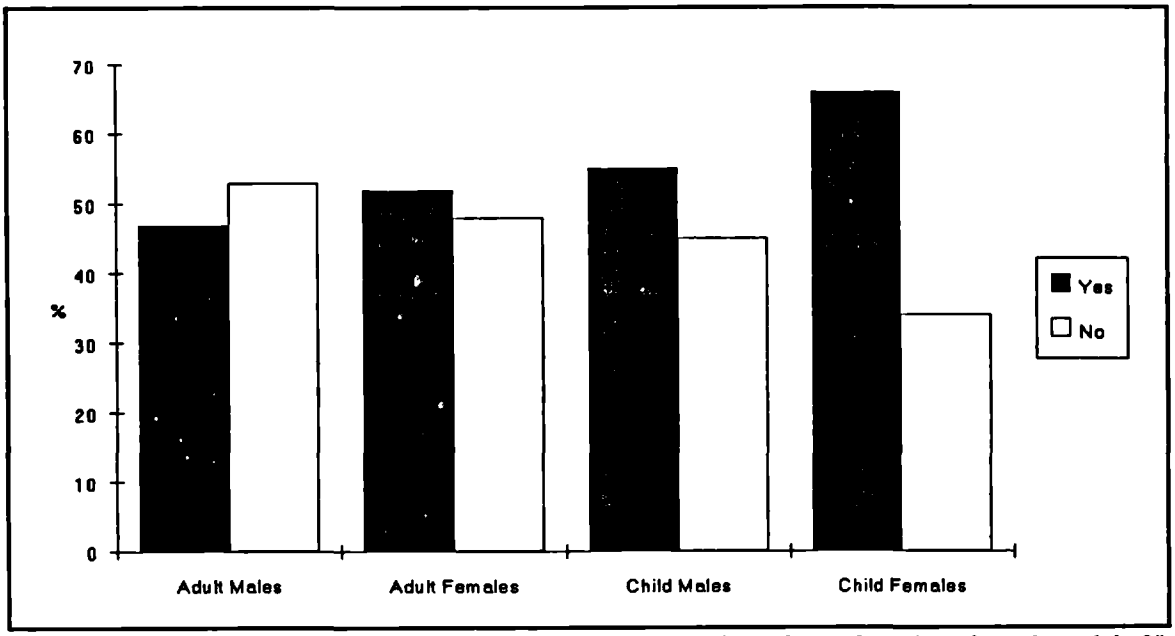

Figure 6g Percentage responses to the PVI question: "Do you think you learned anything from this exhibit?".

them the most, 55% of those who responded (n=348) replied yes - see Figure 6g. The most positive group were girls, two thirds of whom responded positively, whereas only 47% of adult males replied in the affirmative. A few subjects who replied negatively said that they had learned from other exhibits, for example:

> AF: That's an unfair question because the things that might strike you most, you may not necessarily learn anything from them. But I think most people learn something out there. So you're not putting down our nos that we haven't learnt anything as a generalisation? [PVI66]

Of those who thought they had not learned anything from the exhibit which had impressed them, several replied along the lines as suggested in the following quotes:

> AF: Not really - just playing. [PVI27]
>
> 11F: Just fun. [PVI34]
>
> AF: No, no - just found it fascinating. [PVI59]

Some of these replies seemed to me to hint of the view that they could not have learned anything because they had enjoyed it too much i.e. some visitors have a narrow, school-

type view of learning.

This view can be contrasted with those who said things like:

> AM: Yes - you learn without realising it. [PVI46]

Some subjects volunteered their thoughts on learning from interactive exhibits. For example, an adult male who had been impressed and challenged by the HANGOVER PROBLEM said:

> AM: Yes, I did. Determination I think. I think it was the simplicity of a lot of the things. The science behind them - very simple a lot of them weren't they? It was genuine enjoyment of everyone there I think: very little children up to grannies with them. They were all enjoying it - wanting to do it. It's part of learning isn't it? If you're enjoying it you learn something from it. Science was for me always uninteresting because of the way in which it was taught. I understand a lot more today seeing the ideas behind it. [PVI52]

Adults often reflected on the subject of learning and enjoyment:

> AM: It's a fun place for the kids. You watch the little kids running around - they thoroughly enjoy it. Whether they - they must learn something from it. Whether or not it's six months or two years later at school when they start doing the topic that they realise yes, they've seen it before at the Science Museum. Yes, something must stick. [PVI57]

The final question, "Do you feel that Launch Pad is really only for those who are particularly interested in science and technology, or is it for everybody?", was designed to give an indication of how wide was the appeal of Launch Pad. The very large majority of all those who replied (n=333) thought that Launch Pad was for everybody. As Figure 6h shows, one in eleven boys (a greater proportion than any other group) thought that Launch Pad was for those particularly interested in science and technology.

Again, this question prompted visitors to comment on the benefits, as they perceived them, of their visit. The positive reaction of visitors was articulated by the father of an eight year old boy as follows:

> AM: Definitely for everybody. It's an appreciation of what most people know for (the usual ones). It's the start of learning of how things happen although they don't appreciate it at this age. It's the first steps. Just by pumping water up obviously it's how - it's probably how it works in a

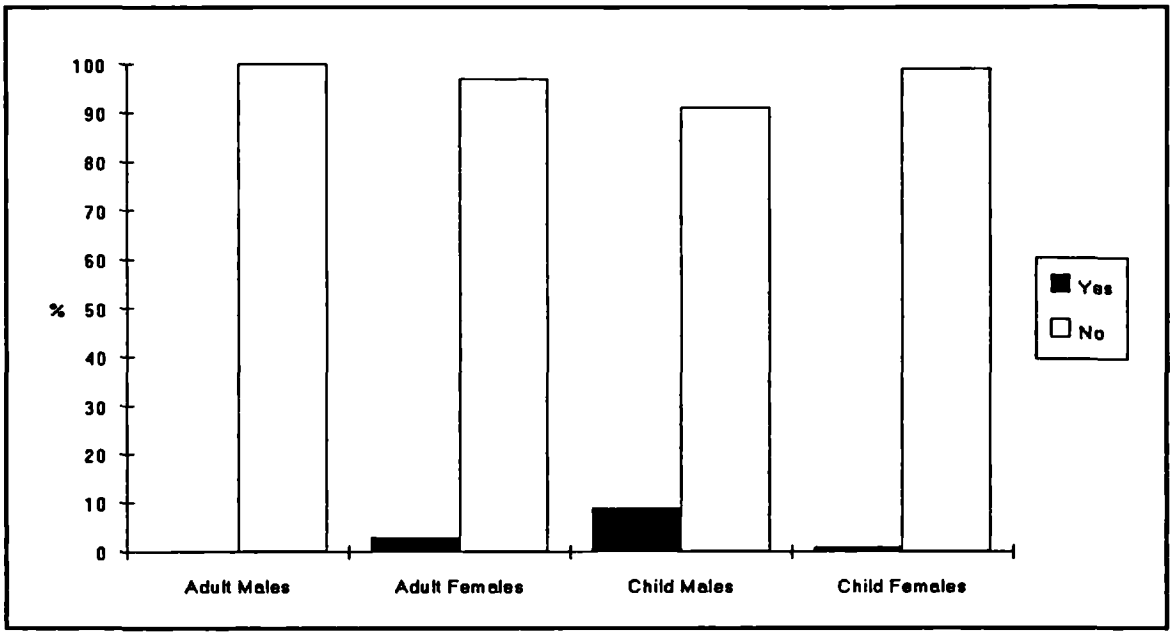

***Figure 6h** Percentage responses to the PVI question "Do you feel that Launch Pad is really only for those who are particularly interested in science and technology, or is it for everybody?".*

house basically. You've got to get it up to the top to get it down again. He wouldn't understand it at this time but it should be clearer in a couple of years' time. So it's a good step of learning for the children and it's just an appreciation for parents of how things really work. [PVI50]

AF: Appeals to those that are curious. They may not be interested in science and technology but the things are there to make them think why. [PVI58]

AF: It shows science in a different way. I think they would learn far more in a small area like that than all day spent in an ordinary science museum. Enthusiasm was enormous. [PVI60]

The father of two boys felt that Launch Pad was really for children:

AM: If you take these two to the V&A they would be walking around saying boring, boring - but they've got something to do here. And that's what makes the difference. [PVI63]

Others felt otherwise:

AF: Very clever - it appeals to children but adults can learn an awful lot. [PVI64]

AM: Everybody - definitely adults. [PVI65]

The mother of two boys aged 10 and 9 on their second visit said:

AF: The last time we came it was actually the first time we've been to a museum - we live in the Channel islands - and they were so impressed with it. We wanted to do something different, but they wanted to come back. [PVI66]

There was a tendency for adults to believe that although there was much in Launch Pad for all ages that it was more suitable for younger children. The following discussion, which was started by the asking of the last question in the PVI, is typical:

AF: I believe it's for everybody. I think you can get something out of it at any level really. It might be very basic like me. I think someone who's interested in it would get a lot out of it.
AM: The beauty of this hands-on science is that you can actually relate it to things around them in the environment. You don't necessarily see it as scientific experiment, but by the same token they can relate it.
AF: It's fun isn't it?
AM: Yes it is fun. It's for everybody. I think primarily for younger ...
AF: The children were having a whale of a time.
AM: You've only got to look at the number of children out there ...
AF: ... and the adults were ...
AM: ... more for younger, it seems to be more for younger children.
10F: Not many adults would try it.
AM: I think to be fair it's probable you can identify a lot of what the experiments are doing without having to do it whereas young children aged 10 or 11 have to actually do that to see the experiment working. So it's not for an older age group. [PVI68]

Another popular view was that Launch Pad was aimed at the family who got a lot out of the experience. The adult male in the first extract comments on his three year old's lack of response during the visit.

AM: Strange environment - he's not really concentrating. If you pin him down in a quiet spell, in about an hour's time he would probably give you quite a bit. I often get a lot of information off him a day later, or in a few hours he would suddenly start and it will all come through.
AF: When we told him we were coming back, what did he want to see? Light up the bikes! [PVI72]

AF: It is nice to come as family and it is lovely today to have seen so many fathers actually explaining things to children. Whereas fathers aren't available during the week very often and it's the mothers who come, whereas on a Bank Holiday it's the family together, which is something you can participate in. But it has been lovely to see a lot of fathers explaining things to their children. I think they have a better grasp of science, in particular, machinery and space - it's all a bit beyond us. [PVI52]

6.4 Conclusions

It is clear from these interviews that the subjects reported almost unanimously that they had enjoyed their visit. Also, 97.6% stated that they found what Launch Pad had to offer was either slightly or much better than that offered by a museum.

Launch Pad has a wide appeal as 96% of subjects stated that they felt that Launch Pad was for everybody rather than just for those who were particularly interested in science and technology. There were conflicting views as to whether Launch Pad was designed more for children than adults. Comments from subjects suggested that there many views concerning the amount of learning which was taking place. It was generally accepted by most subjects that enjoyment and learning went together.

The indicator, ***Impressiveness***, which has been introduced show that the exhibits in Launch Pad have varying appeals both to adults and children as well as to males and females. Although some exhibits impressed more visitors than others, the result that 80% of the exhibits impressed at least one person show that the exhibits have a wide appeal. This result will please the originators of Launch Pad as it would be rather unsatisfactory if just a few exhibits had impressed most visitors.

From the data collected so far, it is reasonable to conclude that Launch Pad has made a large impact on its visitors. The analysis of the Follow-Up Questionnaires and the Follow-Up Interviews will show whether this impact is long-lasting or not.

CHAPTER 7 FOLLOW-UP QUESTIONNAIRES

7.1 Introduction

The overall purpose of the Follow-Up Questionnaire (FUQ) was to assess the impact of a visit to Launch Pad on subjects once the initial immediate effects had died away. By giving the questionnaire to subjects at least two weeks after their visit any short-term effects should not exist, and any interference from further visits is unlikely (as such visits are unlikely to have been made in this interval of time). Details of the methodology are given in section 4.4 on page 80 where it was mentioned that a high percentage (nearly 70%) of the questionnaires were returned. All the questionnaires appeared to have been carefully filled in. The results of the FUQ are described in the order in which the questions were asked. A copy of the questionnaire is given in Appendix F, and full details of the responses to the questions are listed in Appendix M.

7.2 General Opening Questions

The first question asked "What kind of impression did the visit have on you?". It is clear from Figure 7a that 99.5% of those responding were impressed either greatly or somewhat by their visit. Almost two thirds of those who visited stated that their visit had made a great impression on them. These figures are significant as they show clearly the large impact which Launch Pad has on its visitors. There appear to be few differences according to gender, although children were slightly more impressed than adults.

The next question, "Did you talk about the visit with (a) each other; (b) other family or friends?", was designed to assess whether visitors rehearsed their memories with others or not, and to give an indication whether there were any signs of cognitive processing

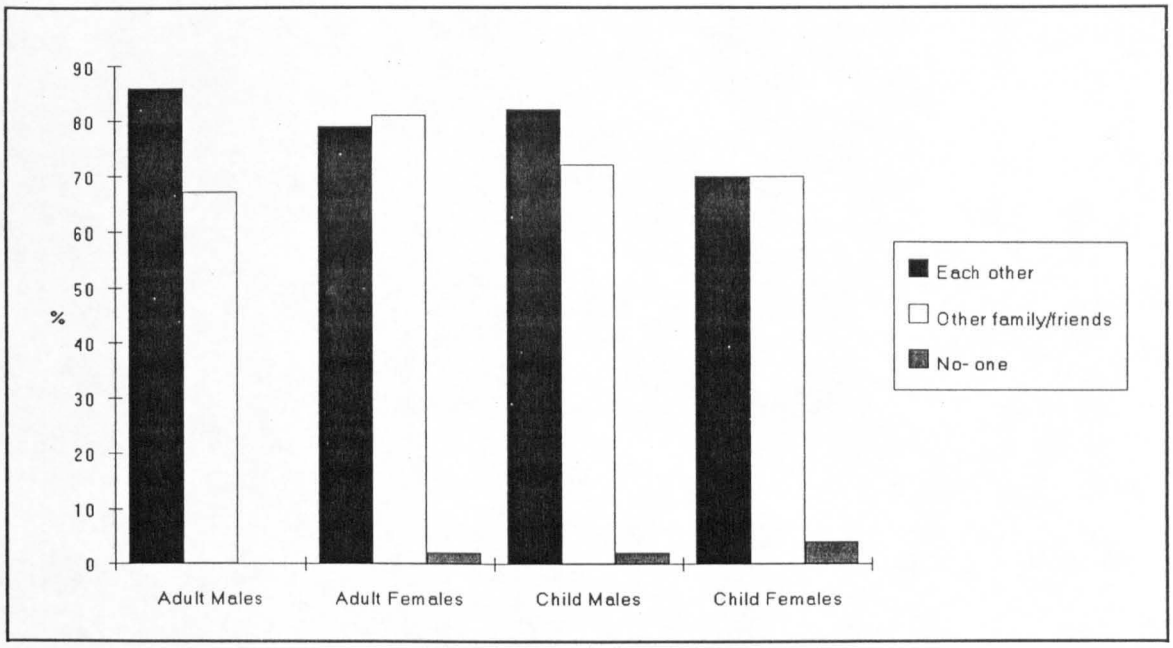

Figure 7a *Percentage responses to the FUQ question: "Did you talk about the visit with (a) each other, (b) other family or friends?".*

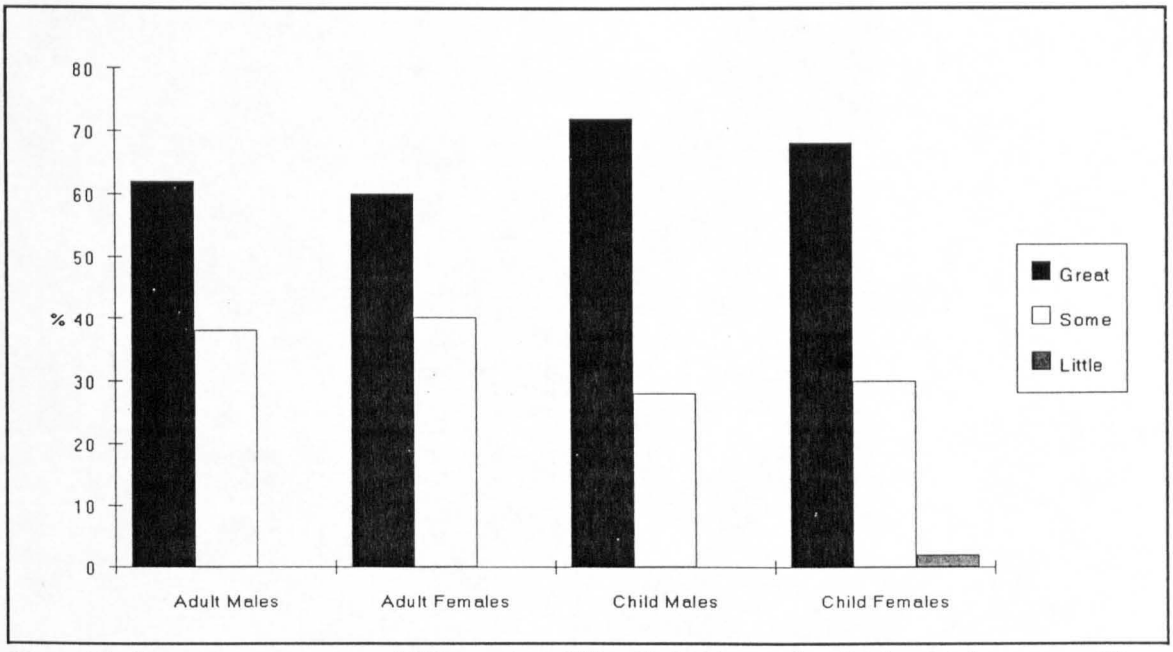

Figure 7b *Percentage responses to FUQ question: "What kind of impression did the visit have on you?".*

taking place after the visit. At a more simple level, the question should also give an idea of the impact the visit had on them - if it was completely bland or inconsequential, for example, then one would expect little talk about it afterwards. As Figure 7b shows, only 2% did *not* talk about their experiences with others.

These findings are a very clear indication of the considerable impact of Launch Pad. About four in five visitors discussed afterwards their experiences in Launch Pad. Of course, it is not possible to assess how much discussion took place, although analysis of question F5 of the FUIs in section 8.2.5 on page 177 will give some indication of this. Seventy three per cent of visitors discussed their experiences with other family or friends.

This discussion also often involved recommending Launch Pad to others as revealed in

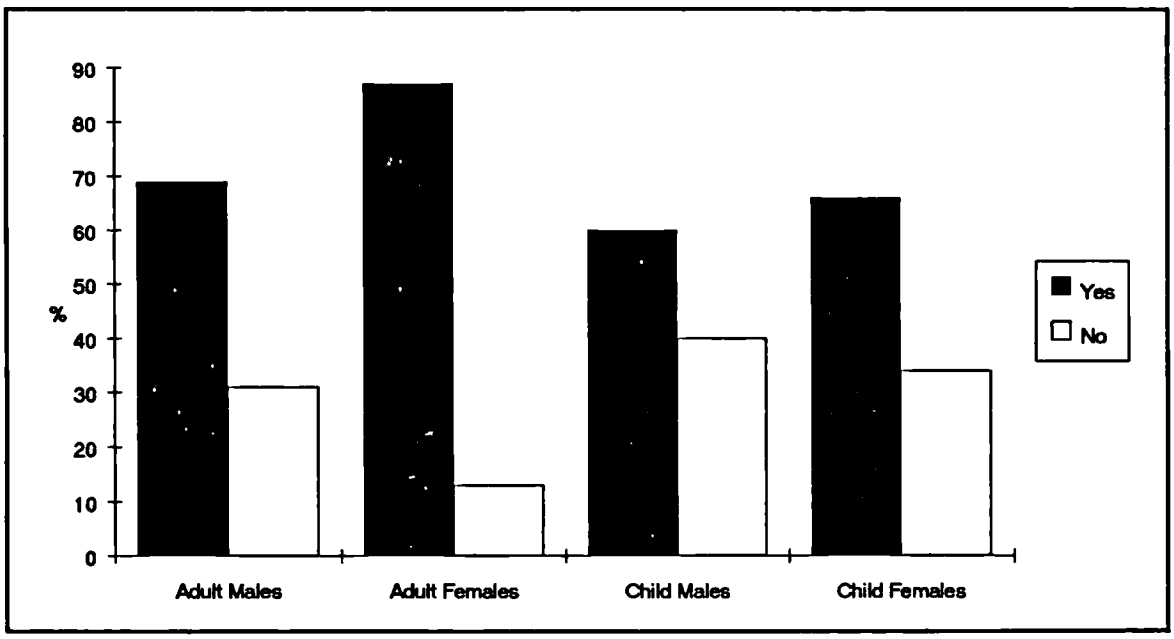

Figure 7c Percentage responses to the FUQ question: "Have you recommended Launch Pad to others?".

responses to the next questions, "Have you recommended Launch Pad to others?", as shown in Figure 7c. Seventy per cent of all visitors stated that they had recommended Launch Pad to someone; children had recommended Launch Pad to their school friends and teachers, and adults spoke of recommending Launch Pad to colleagues at work, for example. Adult females were particularly enthusiastic: 87% of them had recommended Launch Pad. Comparing the numbers responding positively to this question with the numbers who stated that they had talked about their experiences with other family or friends, it should be concluded that, as the numbers are approximately the same, all those who spoke of their experiences also recommended Launch Pad to others.

Taken together, these first three questions reveal that most visitors state they were

impressed by Launch Pad, talked about it afterwards and had recommended it to others. It is hard to draw any other conclusion apart from that Launch Pad had had a great impact on its visitors.

7.3 Best Remembered Exhibit

In the FUQ, each member of the group was asked to write down the name of the exhibit they remembered best. They were then asked to write down what it was about that exhibit they remembered, what they had to do, what happened and what they thought the exhibit was all about.

Out of a possible 75 exhibits (including three demonstrations and the Information Desk), 47 (i.e. 63%) of them were mentioned by at least one person. As explained in section 6.3 on page 122, some exhibits were in Launch Pad when every visitor came whilst others were not. In order to take account of the varying opportunities which visitors had to see the exhibits (and therefore to remember them later) the indicator ***Rememberedness*** of an exhibit is defined as:

$$\frac{(\textit{No of FUQ subjects best remembering exhibit}) * 100}{(\textit{no of opportunities to see exhibit})}$$

Table M-iv in Appendix M shows the number of subjects who chose a particular exhibit together with the number of opportunities subjects had for choosing that exhibit. The ***Rememberedness*** was calculated for adults and children, both male and female, and also the overall figure. The overall figures for ***Rememberedness*** are given in Table 7-i, listed in order, showing that the most remembered exhibits are WATER SCULPTURE (12.5%) and BEAMED VOICES (10.6%). Also highly remembered are GRAIN PIT (7.2%), TURNTABLE (6.6%), TEACH THE TURTLE (6.3%) and PLASMA BALL (5.8%)

Twenty eight of the exhibits were not remembered best by anybody. These exhibits can

Table 7-i Overall "Rememberedness" of exhibits from the FUQ responses.

EX NO	EXHIBIT	*REMEMBEREDNESS*	EX NO	EXHIBIT	*REMEMBEREDNESS*
75	Water Sculpture	12.50	17	Puzzle Corner	0.48
66	Beamed Voices	10.58	23	Watchdog	0.48
41	Grain Pit	7.21	28	Cartesian Diver	0.48
1	Turntable	6.25	31	Giant Steelyard	0.48
19	Teach the Turtle	6.25	60	Car Drag Test	0.48
15	Plasma Ball	5.77	84	Stress Patterns	0.48
24	Kaleidoscope	5.29	85	Bearing Kit	0.48
44	Pedal Power	5.29	99	Hot or Cold	0.48
2	Air Jet	4.81	107	Crane	0.48
140	Laser Circles	3.65	119	Tipper Trucks	0.48
45	Energy Store	3.37	8	Gear Wheels	0.00
59	Colour Box	3.37	10	Roller Run	0.00
112	Heat Pictures	3.37	12	Electric Dust	0.00
25	Slow Bubbles	2.96	13	TV & Magnet	0.00
7	Arch Bridge	2.88	27	Magnetic Pull	0.00
32	Train Wheels	2.40	30	Pulleys & Belts	0.00
55	Flight Test	2.40	33	TwoWay Mirror	0.00
71	Computer Video	2.40	37	Inverting Pendulum	0.00
100	Robot 2	2.17	39	Balancing Blocks	0.00
138	Bubble Demo	2.04	40	Leaning Tower	0.00
21	TipToe Tester	1.92	48	Magnetic River	0.00
109	Flow Tank	1.92	49	Electric Motor	0.00
	none	1.92	67	TV Aerial	0.00
4	Shake Hands	1.44	73	Lock & Key	0.00
11	Pump Kit	1.44	82	Hot Hands	0.00
26	Light Pipes	1.44	83	String Structure	0.00
111	River Bridge	1.44	86	Gyro Wheel	0.00
127	Finger Paint	1.44	88	Robot 1	0.00
6	Bubble Sheet	1.21	94	Pulse Detector	0.00
130	Harmonic Drive	1.10	96	Sounds Flat	0.00
38	Salt Bowl	0.96	106	Hangover Problem	0.00
58	Look Here	0.96	113	Big Optics	0.00
68	Flash Words	0.96	115	Air Engine	0.00
108	Musical Trains	0.93	118	Visible Air	0.00
92	Electric Generator	0.79	122	Colour Filter	0.00
69	Touch Screen	0.52	136	Papermaking Demo	0.00
89	Heavy Pen	0.51	137	Rocket Demo	0.00
9	Human Battery	0.48	150	Information	0.00

be compared with the 15 exhibits that did not impress anybody in the PVIs (see

Table 6-i). From this comparison it can be seen that there was only one exhibit which failed to impress at the PVIs (BEARING KIT) but which was the best remembered in the FUQs - and then by only one person. This suggests that there may be some correlation between ***Impressiveness*** and ***Rememberedness.***

Using Table 6-i and Table 7-i, the exhibits were ranked according to their ***Impressiveness*** and ***Rememberedness.*** Spearman's Rank Correlation Coefficient (see page 88) was calculated for the two rankings and found to be 0.83. The significance of the rank correlation coefficient can be tested using Students' t. In this case, t = 12.68 which is much greater than the 1% significance level of 2.6 for n - 2 = 73 degrees of freedom. Therefore, it can be confidently be stated that there is a very strong correlation between the ***Impressiveness*** and ***Rememberedness*** of exhibits.

7.4 Miscellaneous Questions

Figure 7d *Percentage responses to the FUQ question: "Have you visited Launch Pad since the day of your visit?".*

Most of the remaining questions in the final section of the FUQ were designed to assess whether the subjects had a scientific background or not. The first question in this section

however ("Have you visited Launch Pad since the day of your interview?") was designed to check whether subjects' recollections of their PVI were likely to be interfered with by recollections of other visits since their PVI visit. As Figure 7d shows, only 2% of visitors had re-visited Launch Pad. Therefore most subjects were recalling their PVI visit when filling in the questionnaire.

The question "Do you read New Scientist or Scientific American?" revealed that only 9%

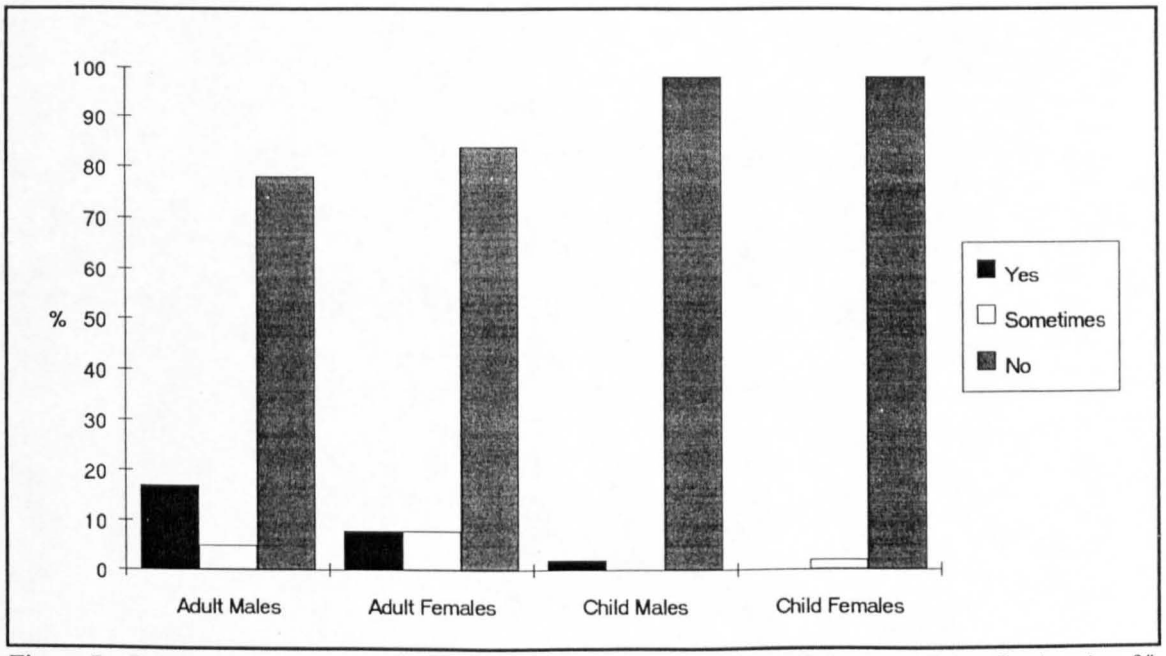

Figure 7e *Percentage responses to the FUQ question: "Do you read New Scientist or Scientific American?".*

of the subjects ever did read either or both of these publications - see Figure 7e. Twice as many adult males than adult females read scientific magazines, although, not surprisingly, only a few children - those in their teens - read these magazines.

The responses to the next question, "Do you watch Tomorrow's World or Horizon?" revealed that many more visitors to Launch Pad watch scientific programmes on television. Seventy seven per cent of subjects watched these programmes either occasionally or regularly. As Figure 7f shows, more adults than children watch these programmes, although just over 50% of the children watch these programmes regularly. The results suggest that more boys than girls watch scientific programmes.

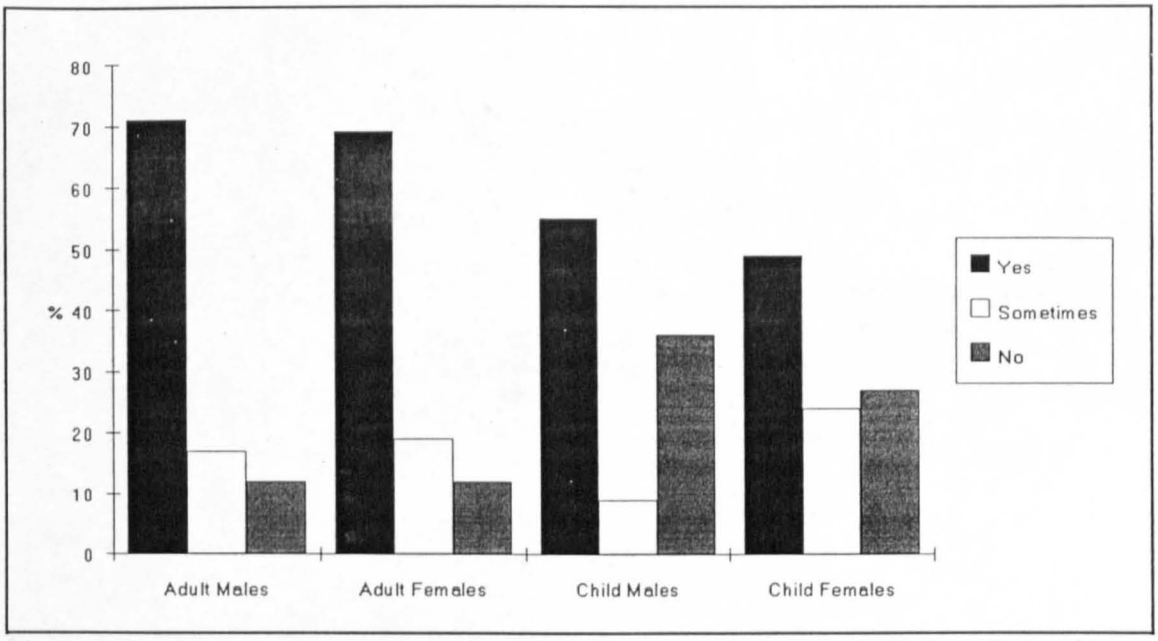

Figure 7f *Percentage responses to the FUQ question: "Do you watch Tomorrow's World or Horizon?".*

Overall, 20% of subjects had acquired some form of scientific qualification, ranging from a PhD to a Cubs' Scientific badge. Not surprisingly, adults were more highly qualified as 32% of them had some form of qualification as opposed to 4% of the children. Also,

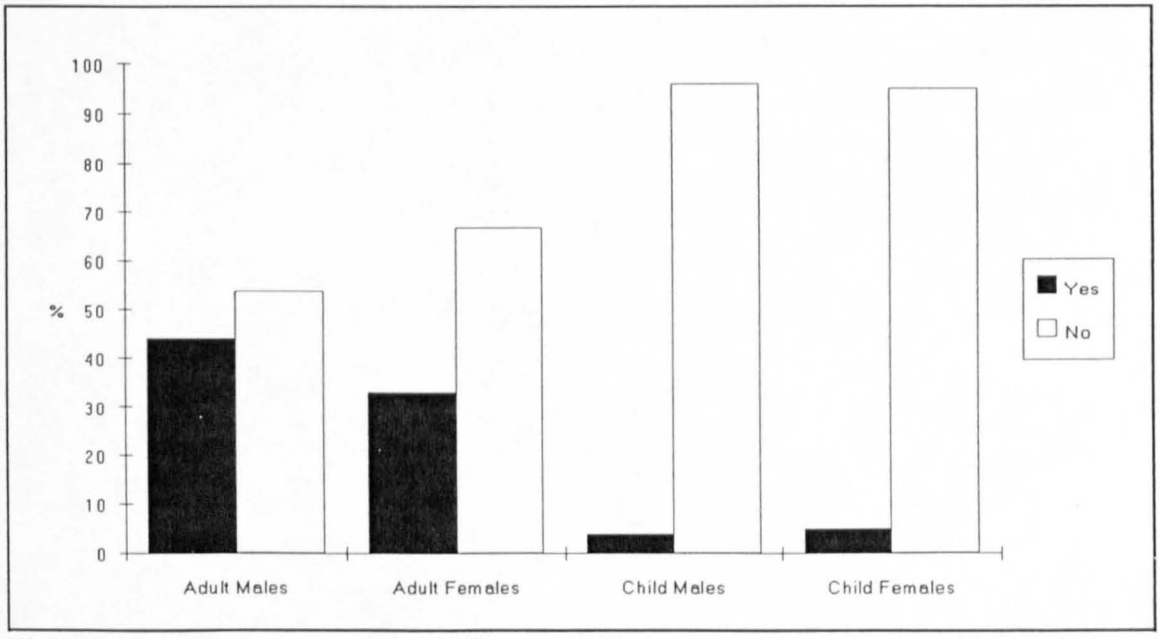

Figure 7g *Percentage responses to the FUQ question: "Have you any formal science qualifications?".*

there were one third more qualified males than females (see Figure 7g).

7.5 Conclusion

Several weeks after their visit 99.5% of those responding to the Follow-Up Questionnaire stated that they had been either greatly or somewhat impressed by Launch Pad. This suggests strongly that Launch Pad has a positive impact which lasts at least a few weeks. This conclusion is reinforced by the finding that 98% of visitors had talked about their visit either with each other or with other family or friends. Also, nearly all of those who had talked about their visit with other family or friends had recommended Launch Pad to them.

The indicator ***Rememberedness*** has been introduced to give an indication of which exhibits were remembered best several weeks after a visit to Launch Pad. In a similar result to that found in the Post-Visit Interviews (i.e. ***Impressiveness*** of exhibits - see page 122), there was a large range of exhibits which were remembered best. Also, there is a strong correlation between those exhibits which visitors said impressed them most immediately after their visit and those which they remembered best after several weeks.

Overall, the results of the Follow-Up Questionnaire indicate that visitors are able to recall exhibits and what they did, thought and felt about them. The conclusion is that Launch Pad has had an impact on its visitors which lasts for at least several weeks.

CHAPTER 8 FOLLOW-UP INTERVIEWS

8.1 Introduction

The Follow-Up Interview was designed to encourage visitors to talk about their experiences through spontaneous recollections in order to assess the impact of their visit.

The Follow-Up Interviews were conducted about six months after the visit, as detailed in Chapter 4, where the structure of the interview is described. Twenty four groups, composed of 79 subjects, were given a Follow-Up Interview (FUI). Tables of raw data associated with this chapter are given in Appendix N.

This chapter is essentially in two parts. First, a general analysis of the FUIs is given together with comment on each question of the interview. Second, a new method of analysing the recollections by subjects of the exhibits is described together with the results of this analysis.

8.2 General Analysis and Comment

8.2.1 Practical information

The first questions, "Can you tell me what day of the week you visited Launch Pad?" followed by "Can you tell me the exact date?", usually started a lively debate amongst the group. Unless the group could relate their Launch Pad visit to a landmark, say after Sunday lunch, there was usually some discussion before a general agreement as to the day of week was arrived at.

> I can't - but I suspect it was probably a Thursday. (3) Well, because whenever - I know it sounds stupid - but whenever we go to London we always go up by train and meet my husband in London, look round the shops on a Thursday night and come home together. [AF/FUI19]

No-one was able to be precise about the calendar date of their visit, although one person was able to identify the day of their visit as being Whit Monday. Groups cooperated to try to identify the date by using a variety of strategies such as it was "near a birthday" or "about the time our season tickets ran out". Overall, groups were generally able to fit their visit into the context of the events of the rest of their lives.

Just over half the groups were able to correctly identify, at the end of their short discussion in which a lot of reminding took place, the day of the week they visited Launch Pad. Exactly half were able to remember correctly the approximate date of their visit in the form "Summer half-term" or "week after Easter" for example.

There was no disagreement as to who the original group consisted of. In only a few cases were there differences in composition between the original group and the group given a Follow-Up Interview e.g. a French boy who had been staying with a family and came to Launch Pad with them was back home six months later when the Follow-Up Interview took place.

Questions B4 and B5 ("What time did you leave home?" and "What time did you arrive at the Museum?") further stimulated the groups' recall of their Launch Pad visit. Over half of the answers were either worked out from a knowledge of how they usually behaved e.g. "We usually get the five past ten." or from their knowledge of their day out e.g. "After lunch, about 1.00." This *working out* was explicitly described by one person:

> AM: Well, what would we have done? Our parents live in Reading so we would have gone up on Easter Holiday. And we travelled from Reading on the Tuesday morning and we returned there on the Tuesday evening to spend Tuesday night there. We usually go up over half-term so the grandparents can see the grandchildren because they don't see them very often. [FUI28]

The times given in answer to questions B4 and B5 are clearly not important. However, the answers do illustrate the wealth of episodic memories associated with their visit to Launch Pad. They can remember how they got to the Science Museum, where they had lunch, what they did afterwards together with numerous other details.

Most groups were fairly sure whether they went straight into Launch Pad or not (question B6), although there was no way of checking the accuracy of their answers. As the data were collected in the school holidays, at weekends and on bank holidays, Launch Pad was usually busy and therefore the ticketing system was often in operation. This was a feature that was clearly remembered:

> AF: Having been before we went straight to see what time we could get in, because we've known before that if you look round the Museum and then try to get in, you might get a time that was two hours later. So we went to Launch Pad to find out what time we could get in and we could get in straight away, so what's we did. [FUI19]

It was possible to check the accuracy of some groups' answers to B7 ("How long did you spend in Launch Pad?") by comparing them with the tracking data. Of the 10 groups that were both tracked and given a Follow-Up Interview:

- 3 were approximately correct
- 5 over estimated their time
- 2 under estimated their time

With the ticketing system in operation, visitors are only allowed to spend up to a maximum of one hour in Launch Pad. This is clearly printed on each ticket and when it is really busy, visitors are requested to leave when their time is up by an announcement over the public address system in Launch Pad. It was curious to note that most of the detail concerning timings and also the date was supplied by adult females. Children were inclined to underestimate their time in Launch Pad whilst adults tended to over-estimate. This suggests that children get very involved in Launch Pad and do not notice the time passing. Casual observation suggests that the parents' task of supervising their offspring in Launch Pad can be quite tiring especially in the middle of a busy day out when all they might want to do is to sit down and rest. This may explain why parents over-estimate.

No-one in 15 of the groups had re-visited Launch Pad. From of the 9 remaining groups, 14 people had re-visited once. This was usually either in a school party or with the Cubs. Not one group had been back as a complete group.

Very few groups had visited anywhere similar (question B9). One group had visited an interactive science and technology centre (the Exploratory in Bristol) and this was before their Launch Pad visit.

8.2.2 Spontaneous recall

In this section of the FUI each individual member of the group was asked to recall some particularly memorable parts of their visit. As an introduction, each person was asked to consider their whole day out, from the time they left home to the time they returned, and to tell me which part of their whole day out they remembered best.

A typical series of replies is given in the following extract:

Me: The following questions ... the next questions I would like each of you to give me your own answers. Now, for this bit, I want you to think about it for a moment before answering, just reflect on it. Which part of your whole day out - that's from when you left home to when you got back that day - which part of that whole day out do you remember best. Which part of it do you say "Ah! That bit really sticks in my mind", or comes to mind first of all?

8M: Plasma Ball - that's what I remember - the lights (and patterns).

Me: So you remember ... You're [12M] is that right? No, Right, so [8M] says he remembers Launch Pad and the Plasma Ball. It doesn't have to be in Launch Pad this time.

12M: I would have said Launch Pad and the kind of grain thing.

Me: [12M] remembers the grain thing in Launch Pad. [14M]? (2)

14M The queue to go in - it was really long.

Me: The queue? Right, [AF]?

AF: I did remember Launch Pad (2) but if I think of it, as a day, I do remember the travelling, because of the children, but Launch Pad would be the highlight. But obviously the practical difficulties and the children were tired afterwards. That sticks in my mind.

Me: Yes, I understand that.

AF: But really I think Launch Pad was very exciting. (2)

Me: Er, [AM], which ...

AM: Yeah, I mean we basically came up to the Science Museum the whole idea of the journey was the Science Museum, yes, the highlight was, because the children enjoyed it so much, and I did, was Launch Pad. But obviously then, there is all the practicalities, and travelling. [FUI31]

Question C1 produced a variety of responses, ranging from recall of someone being car sick to particular exhibits in Launch Pad. Over 70% of the responses were connected

***Table 8-i** Responses to FUI Question C1: "Which part of your whole day out do you remember best?"*

LP exhibits	21	Travelling	8
LP in general	20	Food	4
Talking to me	10	Granddad moaning	1
SM (but not LP)	7	Relief car not stolen	1
SM/LP	58	Journey/Meals	14
London show	2	Stripping laboratory	1
Park	2	Weather	1
Shopping	1		
		Miscellaneous	2
Other events	5		
		Grand Total = 79	

with the Science Museum, or Launch Pad in particular, as Table 8-i shows. Just over half the people interviewed said they remembered Launch Pad as the best part of their day out.

At this stage, 12 separate Launch Pad exhibits were mentioned; the most popular (with number of mentions in brackets) were GRAIN PIT (5) followed by AIR JET (3). Others mentioned were PLASMA BALL (2), PUZZLE CORNER (2), ENERGY STORE (2), PUMP KIT (1), KALEIDOSCOPE (1), SALT BOWL (1), HARMONIC DRIVE (1) and BUBBLE DEMO (1). Only 3 adults recalled a specific exhibit at this stage.

The next largest group (14 subjects - 18%) of recalls was all connected with the journey or meals out in some way. These were of the following form:

AM: Travel on the tube [FUI29]

AF: Well, I remember Launch Pad and what's in it, but I think the funny thing that day was [13F]'s reaction in the taxi! We went up to Buckingham Palace and we went ( ) she was hysterical!
AM: That's what I remember. (3)
AF: Totally unrelated!
13F: While we were waving ... [FUI30]

The remaining recalls were concerned with going to a London show, walking round a park, shopping, the hot weather and stripping a laboratory.

It is significant, although not surprising, that for 10 people, speaking to me was a memorable event. It is unusual for a museum visitor to speak at length with a member of staff and so it is not unreasonable for this event to be easily recalled.

Now the main part of the interview really started with question C2: "Which exhibit do you remember best?". As the memory data on the exhibits is fully investigated in section 8.3 only some outline remarks will be made here. Table 8-ii gives the number of people

Table 8-ii Analysis of FUI responses to question C2: "Which exhibit do you remember best?"

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
41	0	1	1	5	3	8	9	Grain Pit
15	0	2	2	3	3	6	8	Plasma Ball
24	1	2	3	2	1	3	6	Kaleidoscope
66	0	0	0	2	4	6	6	Beamed Voices
44	1	2	3	1	1	2	5	Pedal Power
2	0	0	0	1	2	3	3	Air Jet
59	0	3	3	0	0	0	3	Colour Box
109	1	1	2	1	0	1	3	Flow Tank
138	1	0	1	0	2	2	3	Bubble Demo
140	1	1	2	1	0	1	3	Laser Circles
7	0	2	2	0	0	0	2	Arch Bridge
11	2	0	2	0	0	0	2	Pump Kit
21	0	0	0	1	1	2	2	TipToe Tester
31	1	1	2	0	0	0	2	Giant Steelyard
32	1	1	2	0	0	0	2	Train Wheels
45	1	0	1	0	1	1	2	Energy Store
83	1	1	2	0	0	0	2	String Structure
100	1	0	1	1	0	1	2	Robot 2
111	0	1	1	1	0	1	2	River Bridge
1	0	1	1	0	0	0	1	Turntable
6	0	0	0	0	1	1	1	Bubble Sheet
17	0	0	0	0	1	1	1	Puzzle Corner
25	0	1	1	0	0	0	1	Slow Bubbles
38	0	0	0	0	1	1	1	Salt Bowl
55	0	1	1	0	0	0	1	Flight Test
84	1	0	1	0	0	0	1	Stress Patterns
99	1	0	1	0	0	0	1	Hot or Cold
107	0	0	0	1	0	1	1	Crane
119	0	0	0	1	0	1	1	Tipper Trucks
127	0	0	0	0	1	1	1	Finger Paint
130	0	0	0	0	1	1	1	Harmonic Drive
Total	14	21	35	21	23	44	79	

who recalled each exhibit together with a breakdown according to age and sex. GRAIN PIT heads the list, although this is clearly a young person's exhibit.

There are differences between the sexes, and between the ages, although as the numbers choosing any exhibit are small it is difficult to be definitive. For example, it is interesting to note that only adult females chose the COLOUR BOX and that only children chose BEAMED VOICES.

Overall, nearly half of the exhibits in Launch Pad were recalled as their "best-remembered exhibit" by at least one person. This spread is clearly a good thing and gives evidence of the success of Launch Pad in providing a range of attractive exhibits which appeal to a range of people.

There was an even wider spread of replies to question C3 "Now pick another one you remember well." - see Table 8-iii. Between all those interviewed, 40 separate exhibits were recalled, and this time BEAMED VOICES was the most popular.

8.2.3 Prompted recall

In this section, subjects' memories were prompted by showing them 15 photographs of Launch Pad exhibits in use. The instructions given to each group were just to say whether they had seen the exhibit in the photograph and if so whether they had tried it. Most of the replies to this question did not consist of monosyllabic responses; even those subjects who gave a brief reply tended to elaborate in some way:

Me: Did you have a go on it [8M]?
8M: I don't - oh yes, I did, only a quick go.
Me: Only a quick go, right.
AF: Yes, I remember spending a long time there.
6F: I remember seeing that, I remember.
[FUI19 FLOW TANK]

Usually the photographs prompted a lot of comment which was often quite excited and

***Table 8-iii** Analysis of responses to FUI question C3: "Now pick another one you remember well.".*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
66	2	0	2	0	3	3	5	Beamed Voices
1	0	1	1	2	1	3	4	Turntable
4	2	1	3	0	1	1	4	Shake Hands
21	0	2	2	2	0	2	4	TipToe Tester
6	1	1	2	1	0	1	3	Bubble Sheet
15	0	0	0	0	3	3	3	Plasma Ball
32	1	0	1	1	1	2	3	Train Wheels
41	0	1	1	2	0	2	3	Grain Pit
44	0	1	1	1	1	2	3	Pedal Power
58	1	1	2	1	0	1	3	Look Here
59	1	1	2	1	0	1	3	Colour Box
109	0	2	2	0	1	1	3	Flow Tank
112	0	1	1	0	2	2	3	Heat Pictures
140	1	1	2	1	0	1	3	Laser Circles
2	0	0	0	1	1	2	2	Air Jet
33	0	0	0	1	1	2	2	Two-Way Mirror
71	0	1	1	0	1	1	2	Computer Video
94	1	1	2	0	0	0	2	Pulse Detector
107	0	0	0	2	0	2	2	Crane
0	0	1	1	0	0	0	1	none
7	0	0	0	0	1	1	1	Arch Bridge
11	0	0	0	1	0	1	1	Pump Kit
12	0	0	0	0	1	1	1	Electric Dust
23	0	0	0	0	1	1	1	Watchdog
24	1	0	1	0	0	0	1	Kaleidoscope
25	0	0	0	0	1	1	1	Slow Bubbles
45	0	1	1	0	0	0	1	Energy Store
48	0	0	0	1	0	1	1	Magnetic River
55	1	0	1	0	0	0	1	Flight Test
67	0	0	0	0	1	1	1	TV Aerial
73	0	1	1	0	0	0	1	Lock & Key
82	0	1	1	0	0	0	1	Hot Hands
83	0	1	1	0	0	0	1	String Structure
84	1	0	1	0	0	0	1	Stress Patterns
89	0	0	0	1	0	1	1	Heavy Pen
100	0	0	0	0	1	1	1	Robot 2
106	0	1	1	0	0	0	1	Hangover Problem
111	1	0	1	0	0	0	1	River Bridge
119	0	0	0	1	0	1	1	Tipper Trucks
127	0	0	0	1	0	1	1	Finger Paint
137	0	0	0	0	1	1	1	Rocket Demo
TOTALS	14	21	35	21	23	44	79	

therefore difficult to transcribe accurately as everyone tended to speak at the same time. With large groups the album of photographs had to be handed around as not everyone

could see at the same time. The following extract is of a small group consisting of a six year old girl and an eight year old boy responding to photographs of SHAKE HANDS and ARCH BRIDGE:

> 9M I did see it, I saw it, and I walked up curiously, but and I had a look and it said 'Shake Hands' over the top, so I put my hand in expecting to see another sort of hand come out, and feel it, and shake hands with it. [7F laughs] And I saw a hand going in, when I pulled my - and I thought "Oh" and when I took my hand out, it went out, and then I (thought) it must be some reflection of my hand, and I put it in, and, um, (3) I tried to shake hands with it, but every time I tried to clutch round it, you know, my hand just (turned into a fist).

A moment later, about another exhibit, he says:

> 9M: I noticed that and I walked up to it and the man was there too, and I started, and I, and I put the supports in place, 'cos I'd done it before, and started building it, and he watched me, and then he started building from the other side, but he didn't say anything, but we built, and eventually we built the bridge, I walked, and I pulled out the supports and walked over it, and then (2) sort of beckoned him to have a go, and he did too. [FUI55 SHAKE HANDS & ARCH BRIDGE]

The nine year old boy in the extract above refers not only to his actions but remembers also his interaction with another person; in his case a complete stranger. It was clear from studying the transcripts that subjects' memories of Launch Pad were many and varied; they did not just remember what they did with the exhibit but remembered with clarity the interactions of other people with the exhibit and of people with each other.

> AF: In fact we told some people afterwards what to do because they didn't know what to do with them. So we were very, sort of cocky, and we were telling them what to do with them, because we knew by the time, see. [FUI97 TRAIN WHEELS]

> 12F: Oh, the Lock!
> AF: Oh yes! Yes.
> 12F: Oh yes, we had a go on that!
> AF: Yes, yes, we did use that.
> 12F: Every time we put in a piece in though, like Granddad had a go at us.
> AF: We did sort it out in the end though didn't we?
> 12F: Yes. He goes "No, no, no, look, it's not meant to be like that!" [FUI27 LOCK & KEY]

As the previous extracts have already indicated the members of a group worked in a co-

operative manner helping each other to remember what had happened. If a member of a group was unsure as to what happened other members of the group would often provide reminders until the events were recalled. The ability to distinguish between what happened on different visits was not that unusual, particularly in relation to exhibits that were not working:

> 8F: No I didn't do it.
> AF: That wasn't working, I don't think when we were there. (2)
> 8F: No.
> AF: It wasn't working, we've had a go on it in the past, because I remember, you, wasn't it you and me who had a go and you, the, we found out if you did lots of little bubbles together they caught it up and made a big one. [FUI103 SLOW BUBBLES]

Some subjects did find it difficult to recognise the exhibits from the photographs. One adult female expressed how it was easier to remember an exhibit by looking at the real thing rather than a photograph in the following way:

> AF: No, I can't, the thing is that times when you actually go into Launch Pad yourself and you see them, and you think "Oh yes, I did, I remember" (3) you know I think sometimes it's harder to tell from the photograph than actually being there. Sometimes I'm not sure, if you're standing there you remember more.
> [FUI44 HARMONIC DRIVE]

Another major reason for not seeing an exhibit seemed to be that crowds of people may have obscured the exhibit on the day of their visit:

> AF: Sometimes, though, because we didn't go on something or because we didn't notice it could well have been because there was a queue for it. I mean (.) it doesn't necessarily reflect that we weren't interested in it. [FUI19]

Crowds also affected subjects' abilities to try certain exhibits. On popular days exhibits such as TURNTABLE, ROBOT, etc would often have queues of visitors waiting to use them:

> 13F: It's the one that goes whizzing round. I remember that one. But we didn't have a go, there was a queue.
> Me: You didn't have a go.
> AF: The queue was too long. [FUI30 TURNTABLE]

In the FUIs, 79 subjects were each presented with 15 photographs thus giving a total of 1185 responses. The distribution of these responses between males and females, and

adults and children relate directly to the composition of the FUI groups. Of these 1185 responses there were 900 positive replies (76%) to the question "Did you see this exhibit?" and 668 positive replies (56%) to the question "Did you have a go on it?".

Amongst the 1185 presentations of photographs to subjects at the FUI were 108 of exhibits which were not in Launch Pad at the time of the subjects' visits when they were first interviewed. Also, there were 64 presentations of photographs of exhibits which were not working at the time. Therefore there were a maximum of 1013 presentations to which the subjects could have responded positively. Most of the following analysis is based on these 1013 photographs, thus excluding all the distractors.

Figure 8a shows the percentage of subjects, by age and sex, who responded positively to

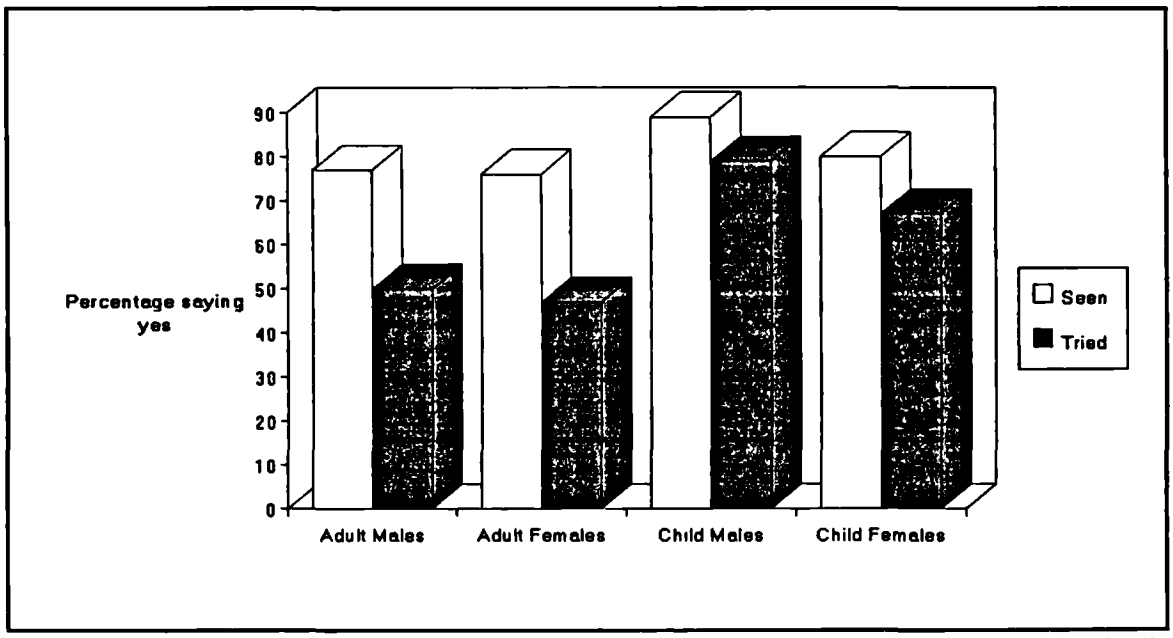

***Figure 8a** Percentage of subjects replying positively to the FUI question: "Did you see or try this exhibit?".*

the question "Did you see this exhibit?". Children appeared to respond slightly more positively than adults. Boys responded more positively than any other group and it was my impression during the interviews that boys appeared to rush to answer, almost boasting of having seen an exhibit.

The percentage of subjects who responded positively to the question "Did you try it?" is

also shown in Figure 8a. Naturally the responses here are lower than for "Did you see it?" although with an average response of over 60% they may still be considered to be high. As with much of the other data in this study, adults respond significantly less than children. The boys' responses are significantly higher than those of the girls and much higher than those of the adults. Later analysis with the tracking data will suggest that the boys' responses are somewhat enthusiastic and optimistic.

So far, the data suggest that overall children respond more positively than adults, that there is little difference in the responses of adult males and females, but that boys respond significantly more positively than girls. Of course without detailed knowledge of which exhibits subjects had looked at it is difficult to assess the accuracy of the subjects' responses. The tracking data contains information on which exhibits some subjects observed and interacted with but not of exhibits which subjects may have seen whilst moving.

There is one distressing result concerning exhibits which were not present in the gallery on the day of the visit and PVI. The presentation of photographs of these exhibits was designed to be an indicator of the accuracy of subjects' replies to exhibits which they were unlikely to have seen. All of the data (tracking, PVI, FUQ and FUI) were studied to see how many subjects might have seen the "absent" exhibits on another occasion. The PVI, FUQ and FUI all contained a question asking whether they had visited previously or since the date of the PVI. Using this information, subjects who had had access to exhibits on other occasions were excluded from the analysis. The adjusted false positive responses are given in Table 8-iv. In total, 79 subjects were presented with 67 photographs of exhibits that they were unlikely to have seen. The

Table 8-iv Adjusted false positive responses to FUI question D: "Did you see or try this exhibit?"

	Seen		Tried		Photographs
	n	%	n	%	n
Adult Males	4	27	1	7	15
Adult Females	4	25	2	10	20
Child Males	5	31	2	13	16
Child Females	6	37	4	25	16
Totals	19	28	9	13	67

figures for "absent" exhibits are between a half and a fifth for the comparable figures for "present" exhibits. Even so it is curious to note that over a quarter of the subjects claimed to have seen exhibits that were not there and a quarter of the girls claimed to have used them.

The data were investigated to see whether there were any differences according to particular exhibits. As Table 8-v shows there is considerable variation from exhibit to exhibit. HARMONIC DRIVE and ELECTRIC GENERATOR are small exhibits which are similar in appearance to other exhibits. TWOWAY MIRROR could possibly been confused with LOOK HERE. Very distinctive exhibits such as TEACH THE TURTLE had a low false positive response.

Table 8-v False positive responses to FUI question D "Did you see or try this exhibit?" by exhibit

		Seen		Tried		Photographs
		n	%	n	%	n
19	Teach The Turtle	1	11	0	0	9
27	Magnetic Pull	0	0	0	0	3
33	Two Way Mirror	6	43	5	36	14
67	TV Aerial	0	0	0	0	7
92	Electric Generator	6	35	3	18	17
130	Harmonic Drive	6	35	1	6	17
Totals		19	28	9	13	67

The responses to photographs of "not working" exhibits is shown in Table 8-vi. Slightly fewer subjects remembered seeing the exhibits which were not working. The percentage of subjects who remembered trying a not working exhibit was half that for the working exhibits. From casual observation, subjects often ignored, or did not see, out

Table 8-vi Responses to FUI question D: "Did you see or try this exhibit?" for exhibits which were not working.

	Seen		Tried		Photographs
	n	%	n	%	n
Adult Males	5	42	1	8	12
Adult Females	13	72	4	22	18
Child Males	15	88	10	59	17
Child Females	13	76	5	29	17
Totals	46	72	20	31	46

of order notices and barriers. In the interviews some subjects specifically recalled that the exhibit in question was out of order.

The data were analysed by exhibit to see what effect the exhibit itself had on the responses. There are some clear differences to the various exhibits, although the sample size for some of the exhibits is too small for the data on them to be reliable. If these small samples (i.e. those less than 5 in number) are ignored then the responses to FUI question D are as given in Table 8-vii - "absent" and "not working" exhibits are excluded.

8.2.4 Further exhibit recollections

In this section each subject was encouraged to talk about at least three more exhibits; although many talked about more. By this time in the interview the group had seen 15 photographs of exhibits and the Launch Pad Book, and had been reminded each of several exhibits. Also, if subjects wished to look further through the album of photographs or the Launch Pad to jog their memories they were not discouraged from doing so; not many subjects did so however.

The first question in this section was about an exhibit they would tell a friend to avoid and it was expressed in the following way:

> Tell me about an exhibit you would tell a friend to avoid. Imagine a friend of yours is coming to Launch Pad. Which exhibit which you tell them to avoid - not to have a go on - and why?

About 40% (i.e. 31 out of 79) of those interviewed said that there were no exhibits which they would tell someone to avoid. These subjects were reluctant to give the names of exhibits to avoid as they thought that the exhibits had varying appeals and even if one person had not liked an exhibit, another person might like it and get something from it.

> AF: I think it's something you've got to go and experience yourself. What would be good for one person wouldn't necessarily be good for another, so I would be hesitant about giving advice to anybody But I think I would advise, and I have already done so, with lots of people "Go and see the Launch Pad, it's something quite different that hasn't been in there

***Table 8-vii** Responses to FUI question D "Did you see or try this exhibit?" by order of percentage seen ignoring samples < 5*

ExNo	Exhibit Name	AM %	AF %	CM %	CF %	n	Seen %	Tried %
15	Plasma Ball	21	24	24	32	38	100	100
24	Kaleidoscope	9	32	32	27	22	100	100
25	Slow Bubbles	21	26	21	32	19	100	58
26	Light Pipes	0	33	33	33	6	100	100
32	Train Wheels	22	33	33	11	9	100	100
58	Look Here	23	23	38	15	13	100	100
59	Colour Box	18	29	21	32	28	100	96
71	Computer Video	18	18	18	45	11	100	82
82	Hot Hands	20	27	33	20	15	100	93
119	Tipper Trucks	25	38	25	12	8	100	50
21	Tip Toe Tester	19	25	29	27	48	98	88
41	Grain Pit	15	26	29	29	34	97	62
44	Pedal Power	14	27	36	23	22	95	77
66	Beamed Voices	18	26	25	31	61	95	75
2	Air Jet	18	18	24	41	17	94	71
45	Energy Store	21	21	36	21	14	93	86
99	Hot or Cold	20	20	7	53	15	93	93
84	Stress Patterns	20	20	50	10	10	90	70
111	River Bridge	12	25	50	12	8	88	50
1	Turntable	15	27	25	32	59	83	53
40	Leaning Tower	14	25	31	31	36	83	58
109	Flow Tank	11	33	22	33	18	83	83
4	Shake Hands	19	25	27	30	64	81	80
30	Pulleys & Belts	19	27	25	29	48	73	40
8	Gear Wheels	22	28	26	24	50	70	50
23	Watchdog	20	30	40	10	10	70	70
107	Crane	15	32	24	29	34	68	29
7	Arch Bridge	11	30	26	33	27	67	33
10	Roller Run	20	20	7	53	15	67	53
100	Robot	17	25	42	17	24	67	46
130	Harmonic Drive	20	27	20	33	30	67	57
83	String Structure	19	25	25	31	48	65	31
85	Bearing Kit	12	25	12	50	8	62	38
140	Laser Circles	25	25	38	12	8	62	50
11	Pump Kit	22	25	25	28	40	48	12
39	Balancing Blocks	21	28	24	28	29	48	41
28	Cartesian Diver	8	33	25	33	12	42	25
	TOTAL					958		

before". [FUI97]

Also, it was felt that one had to try everything (it was thought that children would do this naturally):

AM: You might as well not go if you're going to avoid things, in other words, that's what I'm saying to you. If you're going to go in with the intention of avoiding anything there's no point in going to start with. [FUI28]

There were 48 of those interviewed who spoke of an exhibit which they would tell a friend to avoid. Between them 30 different exhibits were mentioned for a large number of reasons; 19 exhibits were mentioned just once and the highest number of times a

***Table 8-viii** Analysis of responses to FUI question E1: "Which exhibit would you tell a friend to avoid?"*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
0	10	6	16	7	8	15	31	none
45	3	1	4	2	0	2	6	Energy Store
58	1	2	3	0	1	1	4	Look Here
38	0	1	1	1	1	2	3	Salt Bowl
1	0	0	0	1	1	2	2	Turntable
7	0	0	0	2	0	2	2	Arch Bridge
8	0	1	1	0	1	1	2	Gear Wheels
24	0	0	0	0	2	2	2	Kaleidoscope
41	0	0	0	0	2	2	2	Grain Pit
83	0	1	1	0	1	1	2	String Structure
85	0	0	0	1	1	2	2	Bearing Kit
100	0	1	1	1	0	1	2	Robot 2
2	0	0	0	0	1	1	1	Air Jet
6	0	0	0	0	1	1	1	Bubble Sheet
12	0	1	1	0	0	0	1	Electric Dust
17	0	0	0	1	0	1	1	Puzzle Corner
19	0	1	1	0	0	0	1	Teach the Turtle
21	0	0	0	1	0	1	1	TipToe Tester
26	0	1	1	0	0	0	1	Light Pipes
30	0	0	0	1	0	1	1	Pulleys & Belts
32	0	0	0	0	1	1	1	Train Wheels
60	0	0	0	1	0	1	1	Car Drag Test
67	0	0	0	0	1	1	1	TV Aerial
73	0	0	0	1	0	1	1	Lock & Key
94	0	1	1	0	0	0	1	Pulse Detector
99	0	0	0	0	1	1	1	Hot or Cold
109	0	1	1	0	0	0	1	Flow Tank
112	0	1	1	0	0	0	1	Heat Pictures
115	0	0	0	1	0	1	1	Air Engine
119	0	1	1	0	0	0	1	Tipper Trucks
140	0	1	1	0	0	0	1	Laser Circles
TOTALS	14	21	35	21	23	44	79	

particular exhibit was mentioned was 6. This is very wide range and probably indicates that there were not many *bad* exhibits but rather that the subjects' choices and reasons were quite personal. Table 8-viii gives the number of times an exhibit was mentioned as one to be avoided.

ENERGY STORE was the exhibit which was mentioned the most times as one to be avoided. This exhibit was rated as having a high ***Popularity*** and a high ***Interactivity*** from the tracking data and so has a high profile or visibility in Launch Pad. It would be fair to say that the professional staff involved with Launch Pad also had concerns about some aspects of the design of the ENERGY STORE. In this exhibit water is pumped by rotary hand pumps to a large storage tank about 5m above ground level. A rope can be pulled to release the stored water which operates a siren and a flashing light. As the following extracts from a long discussion Group 31 had about the ENERGY STORE show, operating the pumps is hard work and it takes a long time to fill the storage tank with enough water to produce a worthwhile output when the water is released. All too often visitors would pull the release rope before the tank had been filled sufficiently.

> AM: Basically, yes. To get any result out of it required a lot of effort (5) and a coordinated effort of about 4 people. (6) I would say the result wasn't all that, er, for the amount of effort you put in, the result was very, sort of, short-lived, flashed for a couple of seconds, it was all over. I could see what it was getting at, (what it was trying to) show people. [FUI31]

There were many reasons given for telling someone to avoid an exhibit, as has been indicated in the above extracts from the FUIs. There were practical reasons such as an exhibit being too crowded, having long queues or not working properly, and a set of reasons which can loosely be grouped together under the heading "boring/unsatisfying".

> AM: Some of them were a little bit boring, so therefore I've forgotten them. And therefore those are the ones I would recommend them not to go to, but I can't remember what they were. [FUI101]

A reason why visitors can be dissatisfied with an exhibit is that they are unsure whether they are not doing it right or whether the exhibit is broken. Some other reasons for saying an exhibit was one to be avoided were because the visitor "couldn't fathom it out" and "didn't really get what the point was". The large number of exhibits mentioned as

ones to be avoided and the many and varied reasons given for avoiding them show how individual and personal are visitors' reactions to the exhibits in Launch Pad.

Question E2 was "Tell me about an exhibit you understand"; subjects were also told that they were not going to be asked to give a detailed technical explanation, they just had to talk about the exhibit in the same way they had already done. This qualifying statement gave subjects more time to think and reassured those subjects who seemed to be a little anxious when they thought they were going to be asked to explain the exhibits. As has been seen in the some of the FUI abstracts already given some subjects volunteered explanations without prompting. Some subjects were confident (although sometimes incorrect) whilst others were hesitant about giving explanations. Even in the early interviews when subjects were not informed that they did not have to give an explanation, few did so.

The following extract is a fairly typical example of a group of three responding to the question E2:

8M: I think I understand the, um pen with the big weight on the top of it.
Me: Oh yes. Tell me about that one.
8M: think I just, um -
AM: Can't remember that one, what was that one?
8M: No, there was a big pen with yellow weight on the top.
AM: Hmm, and what does it do?
8M: You have to try and write with it, and you can't.
AM: Oh that's right! Is that the one that you set moving and it (2) is that the one I'm thinking of?
8M: It's the one where you have to try and write with it and it don't, it doesn't work that easily (1)
Me: Why's that? (2)
8M: Because there were big weight on the top that puts you off your writing. (2) And when you try and do an el and you go like that, you end up going half way over there. (3)
Me: Hmm (3)
8M: (It was going all over this, that and the other) (3)
Me: Hmm, er [AM].
AM: Yes, the diving machine, I understand probably most of them, but the diving machine that was quite, um, interesting, with the actually squeezing the tube to increase the pressure and er, (1) increase the pressure the divers go down, so you release the pressure and the divers go up.
Me: Hmm, Hmm (6) What do you remember about that exhibit?

AM: It was a nice open exhibit that you could actually see what you were doing to cause the divers to go up and down, um, and I enjoyed (1) with our [4M], trying to get the divers to be motionless, practically impossible, but it was, er, you know, nice to try and do it, it wasn't - I enjoyed that one (1)

Me: Yeah (5). Er [AF], one you understand. [AF giggles] One you understand.

AF: That's the leading question. [laughs] Um (2) what did I understand? I think (1) the water, the hydroelectric power pumping the water up and then pulling it until the lights came on, force of the water making the lights come on.

Me: Hmm.

AF: I think that was pretty (1). Thinking that I could manage that! (laughs) (4)

Me: Good. So what do you particularly remember about that exhibit? (4)

AF: I think seeing how much water was needed to generate the electricity (1). Um, if you (even) thought you'd pumped enough up to make it go, but in actual fact you needed a lot more water, the force to make it actually work. [FUI72 HEAVY PEN, CARTESIAN DIVER and ENERGY STORE]

The adult male in this group is very confident saying he can "probably understand most of them". Others were not so confident, claiming at first they did not understand any of them although they were usually persuaded by the rest of their group that they did in fact understand some of them.

As for the first question in this section, many different exhibits were chosen as being understood. In all, 33 different exhibits were mentioned with PEDAL POWER being the most popular being chosen by 9 people. Next was BEAMED VOICES with 7 mentions followed by KALEIDOSCOPE with 5 mentions. Table 8-ix shows in full the exhibits which people thought they understood. There does not appear to be anything particularly surprising about the results in this table except that 3 adult females said that they understood the PLASMA BALL which is one of the most difficult to explain in Launch Pad. It seemed from their associated remarks that they did not have a very accurate or complete understanding of the PLASMA BALL.

Question E3 asked subjects to talk about an exhibit they had not understood. The 79 subjects between them spoke about 31 different exhibits; again a very wide spread. The most frequently mentioned exhibits (with number of mentions in brackets) were PLASMA BALL

***Table 8-ix** Analysis of responses to FUI question E2 "Tell me about an exhibit you feel you understand".*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
44	2	2	4	2	3	5	9	Pedal Power
66	2	1	3	3	1	4	7	Beamed Voices
24	0	2	2	0	3	3	5	Kaleidoscope
0	1	0	1	2	1	3	4	none
7	0	1	1	2	1	3	4	Arch Bridge
55	0	1	1	3	0	3	4	Flight Test
84	2	2	4	0	0	0	4	Stress Patterns
109	0	3	3	0	1	1	4	Flow Tank
2	0	1	1	1	1	2	3	Air Jet
15	0	3	3	0	0	0	3	Plasma Ball
60	1	1	2	0	1	1	3	Car Drag Test
30	1	0	1	0	1	1	2	Pulleys & Belts
32	1	0	1	0	1	1	2	Train Wheels
41	0	1	1	0	1	1	2	Grain Pit
59	1	0	1	1	0	1	2	Colour Box
89	0	0	0	1	1	2	2	Heavy Pen
106	0	1	1	0	1	1	2	Hangover Problem
1	0	0	0	1	0	1	1	Turntable
4	0	1	1	0	0	0	1	Shake Hands
11	1	0	1	0	0	0	1	Pump Kit
12	0	0	0	0	1	1	1	Electric Dust
13	0	0	0	0	1	1	1	TV & Magnet
17	0	0	0	0	1	1	1	Puzzle Corner
28	1	0	1	0	0	0	1	Cartesian Diver
33	0	0	0	0	1	1	1	Two-Way Mirror
45	0	1	1	0	0	0	1	Energy Store
69	0	0	0	1	0	1	1	Touch Screen
73	0	0	0	1	0	1	1	Lock & Key
83	0	0	0	1	0	1	1	String Structure
86	0	0	0	1	0	1	1	Gyro Wheel
92	1	0	1	0	0	0	1	Electric Generator
99	0	0	0	0	1	1	1	Hot or Cold
111	0	0	0	1	0	1	1	River Bridge
119	0	0	0	0	1	1	1	Tipper Trucks
TOTALS	14	21	35	21	23	44	79	

(9), SHAKE HANDS (8), SALT BOWL (7), BEAMED VOICES (6) and COMPUTER VIDEO (5). The full list is shown in Table 8-x.

As with the previous question there was a wide variation in the levels of understanding, or rather lack of it, that were claimed by the interviewees. Some gave the impression that they had to search hard to find an exhibit that they did not understand whilst others, with

***Table 8-x** Analysis of responses to FUI question E3 "Tell me about an exhibit you did not understand".*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
15	3	2	5	3	1	4	9	Plasma Ball
4	2	3	5	1	2	3	8	Shake Hands
38	0	1	1	3	3	6	7	Salt Bowl
66	0	3	3	1	2	3	6	Beamed Voices
71	1	3	4	0	1	1	5	Computer Video
0	0	0	0	1	2	3	3	none
44	2	0	2	0	1	1	3	Pedal Power
58	2	1	3	0	0	0	3	Look Here
140	0	2	2	0	1	1	3	Laser Circles
1	0	0	0	1	1	2	2	Turntable
10	1	0	1	0	1	1	2	Roller Run
17	1	1	2	0	0	0	2	Puzzle Corner
25	0	1	1	0	1	1	2	Slow Bubbles
45	0	0	0	2	0	2	2	Energy Store
67	0	0	0	2	0	2	2	TV Aerial
68	1	0	1	0	1	1	2	Flash Words
99	0	0	0	1	1	2	2	Hot or Cold
127	0	1	1	1	0	1	2	Finger Paint
2	0	1	1	0	0	0	1	Air Jet
6	0	0	0	1	0	1	1	Bubble Sheet
9	1	0	1	0	0	0	1	Human Battery
19	0	1	1	0	0	0	1	Teach the Turtle
21	0	0	0	1	0	1	1	TipToe Tester
24	0	0	0	0	1	1	1	Kaleidoscope
33	0	0	0	0	1	1	1	Two-Way Mirror
39	0	0	0	0	1	1	1	Balancing Blocks
49	0	1	1	0	0	0	1	Electric Motor
73	0	0	0	1	0	1	1	Lock & Key
84	0	0	0	0	1	1	1	Stress Patterns
86	0	0	0	1	0	1	1	Gyro Wheel
109	0	0	0	0	1	1	1	Flow Tank
130	0	0	0	1	0	1	1	Harmonic Drive
TOTALS	14	21	35	21	23	44	79	

what could almost be described as inverted pride, claimed they did not understand any of them. Most subjects tended to talk about how they did not understand the exhibit in general terms or about how they did not understand how it worked. Examples of these points are given in the following extracts of the interviews:

AM: I don't think there was anything I didn't really understand the principle of. Perhaps the most difficult to grasp was the invisible hand. You know that one and you put your hand in, and it was as though your hand was -

AF: Was coming out to meet you.
[contd later]

AM: I think that the hand was, your hand was highly luminated, but somehow

the background was dark and therefore it looked like the ghost image of your hand against the black background.

AF: Something to do with the shape of it too, because it was a very -

AM: Yes, it was a reflected -

AF: Yes, that's right it was a very deep sort of bell shape wasn't it, so it must have had something to do with the shape of it. (1) I must admit that puzzled me as well. [FUI 101 SHAKE HANDS]

AM: I don't understand how pedalling a bike makes lights go on, I don't understand the basics at all, whether it's complete resistance to concentrate on ( ) the reasons why I don't know, but to me it's just -

AF: But you didn't do science, you didn't do science at (school).

AM: I've never got on with them it just leaves me, the explanations always left me cold and bored and not understanding, impossible for me to fathom out. (3) Just as long as things work, it's O.K. with me, I don't really want to know more. So I don't understand most of them. [FUI44 PEDAL POWER]

AM: Either I couldn't get it to work, or I couldn't understand what the principle was maybe the exhibit wasn't working and I didn't realise, but I was totally lost, but I don't know whether somebody had left the card in the wrong place, or whether some of the things I was supposed to be using were missing, or one of the lights that was supposed to be shining were off, but I got totally lost and I hadn't really a clue what it was on about. [FUI57 FLASH WORDS]

The next question, E4, gave people an opportunity to talk either about an exhibit that they understood or one that they did not understand. More than twice as many subjects chose to talk about an exhibit that they felt they did understand rather than not. Table 8-xi and Table 8-xii give lists of exhibits which people chose to talk about.

Again, it is clear that the subjects chose a wide variety of exhibits and that there are some similarities between Table 8-ix and Table 8-xi, and between Table 8-x and Table 8-xii. The least understood exhibits mentioned in question E4 (PLASMA BALL, BEAMED VOICES and COMPUTER VIDEO) are among the top five least understood exhibits mentioned in question E3. With the very small sample sizes involved it would be unwise to look at these lists in too much detail.

Question E5 was "Can you say whether any of the exhibits were not working? If so, which ones were not?". There is a common impression amongst the professional staff involved with Launch Pad that visitors tend to be very aware of exhibits which are not

***Table 8-xi** Responses to FUI question E4 "Tell me about any other exhibit and say whether it was one you understood or not" concerning understood exhibits.*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
0	0	0	0	2	1	3	3	none
1	0	1	1	1	1	2	3	Turntable
2	0	1	1	2	0	2	3	Air Jet
7	0	1	1	1	1	2	3	Arch Bridge
24	1	0	1	0	2	2	3	Kaleidoscope
44	1	0	1	1	1	2	3	Pedal Power
66	2	1	3	0	0	0	3	Beamed Voices
82	1	1	2	0	1	1	3	Hot Hands
4	0	2	2	0	0	0	2	Shake Hands
21	0	1	1	0	1	1	2	TipToe Tester
25	0	1	1	0	1	1	2	Slow Bubbles
26	0	0	0	2	0	2	2	Light Pipes
32	1	0	1	1	0	1	2	Train Wheels
33	0	2	2	0	0	0	2	Two-Way Mirror
41	0	1	1	0	1	1	2	Grain Pit
45	2	0	2	0	0	0	2	Energy Store
6	0	0	0	1	0	1	1	Bubble Sheet
8	0	1	1	0	0	0	1	Gear Wheels
11	0	1	1	0	0	0	1	Pump Kit
13	0	0	0	1	0	1	1	TV & Magnet
15	1	0	1	0	0	0	1	Plasma Ball
31	0	1	1	0	0	0	1	Giant Steelyard
38	0	0	0	1	0	1	1	Salt Bowl
39	0	1	1	0	0	0	1	Balancing Blocks
60	1	0	1	0	0	0	1	Car Drag Test
73	0	0	0	0	1	1	1	Lock & Key
83	1	0	1	0	0	0	1	String Structure
99	1	0	1	0	0	0	1	Hot or Cold
108	0	1	1	0	0	0	1	Musical Trains
109	0	0	0	0	1	1	1	Flow Tank
111	1	0	1	0	0	0	1	River Bridge
115	0	0	0	1	0	1	1	Air Engine
TOTALS	13	17	30	14	12	26	56	

working properly and to exaggerate their numbers. This impression is also believed to hold true for all kinds of interactive demonstrations in museums. Table 8-xiii shows that 33, out of the 79, people interviewed could remember an exhibit that was not working, and most of them could talk about the not working exhibits in detail.

AF: Oh, I'm sure there were some. There were about five.
Me: About five.
AF: There was only about one on the top level but down on the bottom level there seemed to be ever such a lot.

***Table 8-xii** Responses to FUI question E4 "Tell me about any other exhibit and say whether it was one you understood or not" which were not understood.*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
15	0	1	1	0	4	4	5	Plasma Ball
66	0	1	1	1	1	2	3	Beamed Voices
71	1	0	1	2	0	2	3	Computer Video
59	0	1	1	0	1	1	2	Colour Box
4	0	0	0	0	1	1	1	Shake Hands
6	0	0	0	0	1	1	1	Bubble Sheet
17	0	0	0	1	0	1	1	Puzzle Corner
21	0	0	0	0	1	1	1	TipToe Tester
24	0	0	0	1	0	1	1	Kaleidoscope
25	0	0	0	1	0	1	1	Slow Bubbles
26	0	0	0	0	1	1	1	Light Pipes
33	0	0	0	1	0	1	1	Two-Way Mirror
44	0	0	0	0	1	1	1	Pedal Power
140	0	1	1	0	0	0	1	Laser Circles
TOTALS	1	4	5	7	11	18	23	

Me: Can you tell me (.) what they were, or what they looked like.

11F: There was one (.) something like you know you've got those metal casings on some of the things? There was a metal casing there and a metal casing there and a sort of bar joining them on either side and there was some generator or something like that in the middle of them but I don't know what it was (.) and there were a few others. They were all something to do with motors and electricity, most of them (4)

Me: [AF], can you remember one that wasn't working?

AF: The harvest (.) The combine harvesting didn't seem to be working all the way round. It seemed to be getting clogged up at places and you weren't getting a full cycle. (.) How now I can't remember. (.) Oh, and the television aerial, whether it was because I couldn't get it work or because it wasn't working I don't know. (.) That again couldn't get the clear picture.

11F: Yes, but they have out of order written on them if they're ( ) the ones down the bottom. [FUI20 ELECTRIC MOTOR, GRAIN PIT & TV AERIAL]

On the exhibit daily status table (Table J-ii), none of these exhibits was marked down as not working on the day that this group visited, although they may have been not working when the group saw them and then been repaired. The description of the GRAIN PIT not working seems to suggest that there might have been too much grain in it or that it may have been misused. There was definitely one large exhibit which was not working on the day that they visited and this was not mentioned. There was a degree of uncertainty amongst the subjects as to whether the exhibit was faulty or whether they were not using

***Table 8-xiii** Responses to FUI question E5 "Can you say whether any exhibits were not working? If so, which ones?".*

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Exhibit Name
0	6	13	19	12	15	27	46	none
127	0	0	0	3	3	6	6	Finger Paint
25	2	2	4	1	0	1	5	Slow Bubbles
41	1	1	2	1	0	1	3	Grain Pit
100	0	0	0	2	1	3	3	Robot 2
6	1	0	1	0	1	1	2	Bubble Sheet
26	0	1	1	0	0	0	1	Light Pipes
31	0	0	0	0	1	1	1	Giant Steelyard
44	0	1	1	0	0	0	1	Pedal Power
45	1	0	1	0	0	0	1	Energy Store
49	1	0	1	0	0	0	1	Electric Motor
58	0	1	1	0	0	0	1	Look Here
59	0	0	0	1	0	1	1	Colour Box
60	0	0	0	0	1	1	1	Car Drag Test
75	0	0	0	0	1	1	1	Water Sculpture
83	0	1	1	0	0	0	1	String Structure
94	1	0	1	0	0	0	1	Pulse Detector
108	0	1	1	0	0	0	1	Musical Trains
115	0	0	0	1	0	1	1	Air Engine
119	1	0	1	0	0	0	1	Tipper Trucks
TOTALS	14	21	35	21	23	44	79	

the exhibit properly.

AF And one poor technician was on the water pump, he was showing somebody else and we thought that was broken, but he'd put it together incorrectly [laughs] (1) so that was, I don't think any of the others weren't working, were they?

AM No, but the um, the bubble machine, we couldn't, we couldn't get a full bubble on it, could we?

AF No.

AM I don't know whether the juice was running out of that, um you could get so far up with it, no matter how gently you went up, um, you couldn't get a full bubble as shown in the book here (3) I think everything else was working. [FUI72 PUMP KIT & BUBBLE SHEET]

AM: No, the one on the balcony, I don't know whether it wasn't working or whether I picked up the card in the wrong place, or whether I ( )

10F: No, you picked up a magnifying glass that ( )

15F: Yes there were different magnifying glasses, the one (we tried) and they had different shaped lenses and you had to hold them up and read something and it didn't make much difference really! I'm not sure what happened. [FUI57 FLASH WORDS & LOOK HERE]

It seems to be a feature of human nature than a crowd attracts other people and in Launch Pad observation suggests that a exhibit which is being used does attract other people. A

Table 8-xiv Responses to FUI question E6 "Did you see any of Launch Pad staff? If so, what were they doing?".

Exhibit Number	Adult Males	Adult Females	Adult Total	Child Males	Child Females	Child Total	TOTAL	Activity
0	6	1	7	8	12	20	27	none
601	2	6	8	2	4	6	14	Entrance desk
607	3	2	5	2	0	2	7	Unobtrusive
605	1	3	4	1	1	2	6	Explaining
604	1	2	3	0	0	0	3	Me following them
611	0	2	2	0	1	1	3	Assisted with ex
136	0	0	0	2	0	2	2	Paper Making Demo
602	0	2	2	0	0	0	2	Repairing exhibits
606	0	0	0	1	1	2	2	Sitting around
608	1	1	2	0	0	0	2	Me
613	0	0	0	1	1	2	2	Information Desk
1	0	0	0	1	0	1	1	Turntable
55	0	0	0	1	0	1	1	Flight Test
603	0	0	0	1	0	1	1	Keeping watchful eye
609	0	0	0	0	1	1	1	Telling kids to stay
610	0	1	1	0	0	0	1	Talked informally
612	0	1	1	0	0	0	1	Presence variable
614	0	0	0	0	1	1	1	Demonstration
615	0	0	0	0	1	1	1	Helper on TV
616	0	0	0	1	0	1	1	Asking questions
TOTALS	14	21	35	21	23	44	79	

corollary of this is that an exhibit which is not being used is not attractive, as expressed in the following extract:

> 14M: Not exactly because I didn't go near them. I saw they were not like the others - lively - and everybody was steering clear of them. I didn't look at them. [FUI31 PLASMA BALL]

The last question in this section was "Did you notice any of the Launch Pad staff? If so, what were they doing?". Two thirds of those interviewed said that they had seen a member of staff and described what they doing at the time. There were staff in Launch Pad at all times, and at busy times staff were on the door issuing and checking tickets, so everyone had the opportunity to see a member of staff. The role of the helpers or "explainers" is to talk to visitors in Launch Pad, answer questions, encourage exploration

and discovery, or perhaps just talk about the weather. They were rather discreetly dressed and kept a fairly low profile in order not to make visitors feel threatened in any way. The following quotes show that this strategy has been successful, although some visitors were not able to find a helper when they needed one.

AF: Well I didn't notice, except for the one making paper, obviously, and I, after thinking about it afterwards, I wish there'd been a few around, but I didn't realise they were around.
[contd a short while later]
14M: You don't want people looking over your shoulders. [FUI31]

AM: I think we noticed them, but didn't want them particularly to stand in our way.
[contd later]
AF: And it's quite different if you talk someone in a white coat, once you got into Launch Pad, it's different. [FUI43]

The helpers also had a role to play in the first-line maintenance of exhibits and the giving of demonstrations, but were also there for visitors to talk to about what ever they wanted. These and other duties are reflected in the analysis of the responses to question E5 given in Table 8-xiv. From this table it can be seen that the activity of the helpers which attracted most attention (14 responses) was their role at the entrance desk handing out tickets etc. This is closely followed by their "helping" role which can be said to consist of "explaining", "assisting with exhibit", "asking questions" and activity at a particular named exhibit; 12 responses in total.

AF: I seem to remember him giving an explanation to somebody. [FUI70]

AM: Answering our questions, why things these bloody things weren't working. They were nice, weren't they?
11F: Yeah. And one of them was from a programme, BBC and [14M] said it was the lady from Know How. [FUI92]

8.2.5 Feelings

This section was concerned with finding out what the subjects' general feelings were about Launch Pad itself. It began by giving each of the subjects a list of 15 phrases briefly describing Launch Pad which they were asked to tick if they thought they were particularly accurate descriptions. Subjects were told they could tick as many as they wished.

The 15 phrases were chosen to cover the range of positive feelings which initial investigations had shown people have about Launch Pad. Only *positive* feelings were chosen as it was already known that the majority of visitors have mainly positive feelings and I wished to explore which kinds of feelings prevailed. As already noted in the section on Professional Views on page 27, there is a common view that the enjoyment of the experience dominates. Therefore the phrases were chosen to cover evenly the three main areas of activity, feeling and thought which are defined in the Exhibit Memory Analysis section on page 185 in order to test the accuracy of this view.

Each subject was given a sheet of paper listing 15 phrases describing Launch Pad and asked to tick the ones which they felt were the most accurate description of Launch Pad. Young children were assisted with the reading, and sometimes the interpretation, of the phrases. The data were analysed by totalling the number of positive responses to each phrase and by putting these totals in rank order.

Table 8-xv Overall ranking of FUI subjects' responses to Phrases.

Rank	%	(n)	Phrase
1	83	(65)	makes you want to have a go
=2	78	(61)	sets you thinking
=2	78	(61)	can do it yourself
4	77	(60)	you can see how things work
5	73	(57)	it's all great fun
6	62	(48)	very entertaining place
7	58	(45)	makes a big impression
=8	53	(41)	difficult to tear yourself away
=8	53	(41)	it looks attractive
10	51	(40)	catches your imagination
11	46	(36)	never a dull moment
12	45	(35)	it's quite a challenge
13	36	(28)	lots to do with others
14	26	(20)	must try until you've solved it
15	24	(19)	takes you by surprise

Table 8-xv shows the overall ranking of the

phrases by all the subjects. It is interesting to note that descriptions of feelings or enjoyment do not head the list. Over 80% of subjects felt that Launch Pad was a place which stimulated them into wanting to have a go. This is clearly encouraging to the founders of Launch Pad and for other interactive centres as this is evidence that Launch Pad is achieving one of its main objectives. In third place is "can do it yourself" which also supports the view that the hands-on nature of ISTCs is very attractive. "Sets you thinking" is in second place, and this together with the high placing of "you can see how things work" clearly does not support the view that people just run around enjoying themselves without thinking. Enjoyment is important however as it occupies the next two places.

There is significant agreement about the rank order of the phrases between males and females, and between children and adults. As Table 8-xvi shows, there is significant agreement at the 5% level between adult females and adult males although there is less significant agreement between child males and child females. The data suggest that boys may be the "odd ones out". It is interesting to note that for both boys and girls "makes you want to have a go" is top of the list. This suggests that children are inspired and motivated by the atmosphere of Launch Pad to explore and handle the exhibits. Phrases such as "it's all great fun" are near the top but so are phrases such "you can see how things work" and "sets you thinking". Children therefore clearly do not see Launch Pad as just a giant fun-fair but see it as a very enjoyable interactive educational experience. Adults put the hands-on nature of Launch Pad top of their list closely followed by "sets you thinking" and "you can see how things work". Therefore adults view Launch Pad as a place where children can get their hands on exhibits and find out things in an enjoyable way.

Most people did not select the phrase "must try until you've solved it" very often. Other data suggest that visitors did persevere with difficult exhibits and so the evidence here suggests that visitors do not feel under any pressure in Launch Pad to succeed, or find the experience threatening. It is slightly curious that the phrase selected least often was "takes you by surprise". Many exhibit fabricators insist that a good interactive exhibit

***Table 8-xvi** Comparison of rankings of FUI Phrase data by age and sex.*

	Rank AM	Rank AF	Rank CM	Rank CF	Phrase
1	1	=4	=3	=6	you can see how things work
2	=3	1	6	5	can do it yourself
3	=11	=13	14	15	takes you by surprise
4	=13	=11	12	=6	never a dull moment
5	15	15	15	10	must try until you've solved it
6	=7	8	11	=2	very entertaining place
7	=11	14	=7	=12	lots to do with others
8	10	6	=7	=12	it looks attractive
9	2	=2	5	2	sets you thinking
10	=3	=4	1	1	makes you want to have a go
11	5	7	2	=2	it's all great fun
12	6	=9	=7	11	catches your imagination
13	9	=9	=7	8	difficult to tear yourself away
14	=7	2	6	9	makes a big impression
15	=13	=11	=3	=12	it's quite a challenge

Spearman's Rank Correlation Coefficients:

	AM	AF	CM	CF
AM	1.0000			
AF	0.8309	1.0000		
CM	0.6281	0.4706	1.0000	
CF	0.6567	0.5908	0.4755	1.0000

(critical value of Spearman's Rank Correlation Coefficient for 5% confidence level = 0.6411)

should surprise the visitor in some way so that it encourages them to explore further. Other data in this chapter show that visitors often do not understand the exhibits; perhaps the conclusion to be drawn is that visitors are not surprised when they do not understand?

The next two questions in this section were:

What do you think you got out of your visit?

How do you feel about Launch Pad?

These questions were designed to encourage people to talk about Launch Pad in general and to express their feelings about their experiences. There are common themes running through the answers to all three questions and there was a considerable amount of overlap

between the answers to these questions. So the following analysis sometimes considers these themes by looking at the answers to these questions together.

There was an overwhelming positive response to these questions; there being only one exception. Words such as "great", "brilliant", "fabulous", "impressive", "fascinating", "good" etc were used frequently in visitors' descriptions of their feelings. Children particularly were keen to speak about how much they had enjoyed their visit, but their comments revealed that there was much more to their visit than just pleasure. Adults and older children tended to dominate the conversation as they tried to put into words their many, varied, and often complex, feelings and ideas.

11M: A lot of enjoyment.
[contd]
AF: Fun as a family.
[contd]
14F: Learning something new, something that you've never known before. Something you've always wanted to do.
[contd]
14F: It's fun to learn as well, not as if it's like books and stuff (5)
AF: I think if science had been like that when I was at school, I'd have learned far more. Or understood far more than I did at that age. (9) I can remember finding science pretty boring, I wanted to drop out as soon as possible.
[contd]
AF: It was the practical, actually being able to put your hands on and see (3) the effects that one thing has against another, so you see the principle working, rather like we teach children nowadays, it's by the doing, and finding out by actually doing things, rather than being told.
[contd]
14F: Yeah. It's best to find out by yourself rather than being taught 'cos you're learning more that way, rather than being told "Here's the facts, this is how it works, copy it down and learn it", sort of thing.
[contd]
AM: Um, bit like (said earlier) it's the practical side of hands-on experience of things as opposed to passive, um (3) exhibits can actually do things and handle things. I think that's the key with children.
[contd]
AM: All sorts of things come into it, like working together (2) on a project it's important (3) um, but not when people interfere, when you have to tell people from time to time "Leave that, don't do that, we're doing this, don't pull the cistern yet (2) until we've filled it right to the top". That was the effect of saying, but hopefully people would learn from that, that certain things follow on from something else. (5) I mean, one or two people said

exactly the same, because generally they, "Don't pull the cistern handle yet, er chain, until, other people have got all the water up there". [contd]

14F: Also it relates to some work that you're doing at school. You'd go up and see a thing, and you'd think "Oh, I did that in second year", or something, and it helps you understand more what you learned. Adds to it. [contd]

11M: Well, it's, um, very good enjoyment, and a good day out. (10) And I learned quite a bit while, while I was there. [FUI101]

It is clear from the above extract how enjoyable and worthwhile this group found their visit to Launch Pad. Their comments emphasised the fact that they found it "fun as a family" and not just fun on an individual basis. Linked to this is their reference to working together as a team, not just as a family but with other families as well. The hands-on nature of Launch Pad is an important element: "actually being able to put your hands on and see". Implicit in their conversation is the fact that they did actually interact with the exhibits. These themes, as expressed in this paragraph, correspond closely with the results of the data from phrases about feelings.

Many visitors made comments combining the enjoyment and educational aspects of their visit:

AF: Educational entertainment? (2) It was an enjoyable day where you felt the children were learning something (.) but being entertained at the same time. [FUI19]

AF: ..... it was like an adventure playground but with a scientific base. [FUI20]

9M: It was a fun way of learning. [FUI55]

Parents, particularly, thought that a visit to Launch Pad was a good day out (or a good half day out) for the whole family. They derived a lot of pleasure by watching their children enjoying themselves and gaining something from the experience.

AF: For me it was a case of there aren't many places where I could take my three children of their ages and they'll be happily occupied in that way and, hopefully, come away with a bit of understanding. (.) So it was like to me it was like an adventure playground but with a scientific base. [FUI20]

AF: From the point of view of the children, taking the children, as a

> parent, I thought it was really valuable. It was an exciting experience, because it was visually good, and the fact that they can touch, they can produce an example, and because its fun and they take part in ( ) they do it on their own, they remember it so much more. [FUI31]

There was a tendency for some adults to consider Launch Pad as a place really only suitable for children, although this was a view which was quite strongly disagreed with by others. The one subject who did not like Launch Pad at all herself was able to see the benefits it had for her children:

> AF: Personally, I didn't gain anything, its just not the sort of place where I would choose to go. I do get pleasure from watching children; I enjoy children of all ages, being fascinated about learning. [FUI30]

The adult male in the same group expressed this view in the following way:

> AM: A challenging and interesting introduction, to the extent where they take it from there will depend on what they hear in school and whether they recognise what they're taught and what they saw. However, that does sound terribly pompous, I am very difficult to (please). (4) I thought it was good. As, what is called "Launch Pad", that's presumably that's what it has given them - a first introduction to science, the way I look at it. [FUI30]

As a day out, Launch Pad was often compared favourably to a traditional museum:

> AF: It's a nice outing where you hope they might learn something as well. (7) And whereas I would have a lot of trouble dragging them around the National Gallery or the Natural History Museum, they, um, they are prepared to come to the Science Museum (now it has) the Launch Pad. I can't say they were very willing before. [FUI107]

> 15F: But when you go to museums, you all look round and you look at this and you look at that and you look at something else and you wonder how (the three are related) and usually you end up, bored out of your tiny mind at the end, so you just walk round looking at things in cases which shows "this is such and such and it does such and such" but you can actually work it in Launch Pad. [FUI57]

Visitors frequently compared their experience of science in Launch Pad to that which they had experienced in school. In all cases, visitors preferred the way science was presented

in Launch Pad, mainly because of its hands-on nature. It was particularly interesting to note that many adult females who had had a bad experience of school science (or even who had not received any school science education) were able to respond positively in Launch Pad, which they perceived to have a very non-threatening environment. Despite their lack of scientific education they felt able to work with their children (who often knew more science) at the Launch Pad exhibits.

> AF: I didn't do any science or have any scientific education at school whatsoever and I found it rather, (5) pleasing, that the, the things on show, the exhibits, I could do them and I could explain, explain a little bit about them without any background knowledge at all. [FUI72]

The two adults talking in the following extract are brother and sister, and the male is an artist who had been turned off science at an early age:

> AM: It was never around when I was a child. If it had been I doubt if I would be ignorant now quite honestly. It was never made that enjoyable when I was a child.
> [contd]
> AM: But it did make me think that if that sort of facility had been available, then people like me, which I'm sure there are a lot, it would have made things a lot easier to understand. (1) They can take part in the way that you can with Launch Pad. (9) I mean when I was that age things were very technically delivered, normally formulae that turned one off. I was immediately turned, turned one off. [FUI44]

The interactive nature of Launch Pad clearly was an important factor for the following group of an adult female and her two daughters aged 8 and 12:

> AF: I enjoyed it, definitely. Yes when you tend to think of science to tend to think of it up there or I have done in the past, but it definitely changed the image I think of science. (1)
> 12F: Like when you go to these museums, you think "Oh everything in glass boxes" and you can't touch anything. If you go near some of the things "Oh get away from here" but like you can muck around with it all. (3)
> [contd]
> 12F: Its like a massive playground, isn't it, like. You learning something at the same time, you don't realise it until you get out or until you go to the next science lesson and you say "Oh great, I know what you're talking about". [FUI27]

The 12 year old girl in the above extract sums up well one of the educational benefits of

Launch Pad by saying that when a similar effect is encountered in school science then she would "know what you're talking about". Two 14 year olds in different groups spoke of this benefit as follows:

> 14M: It might help me solve something in the future. You know that you can't really forget it, because its stuck in your mind. You saw that, and you did it, and you know how it works. [FUI31]

The parents in another group spoke in a similar way about the effect they thought Launch Pad had had on their 9 year old son:

> AM: I think its an excellent idea. One of the best things I've seen. Um, (4) though [9M] says he got nothing out of it, I'm sure he did. You know, as things go (on) the penny will suddenly drop and the things he will remember.
> [contd]
> AF: But to actually do it and be able to demonstrate just how it works, I'm sure children must find it much easier than just a formal explanation. ( ) I mean we have experiments at school, but I mean they're usually done rather than you participating in them. [FUI40]

There was some difference of opinion as to whether there was enough information or explanation available. The adult male in the following extract thought there was:

> AM: Well I think obviously it's been designed with a great deal of thought, and, er, to try and, er, explain fairly, er, straight forward, er, things which we take for granted. And, er I think that was the beauty of it, that er, er, there were things in there that were explained, things that we had always accepted as being a matter of fact, and um, and in a very relatively simple way which most people can understand, it was, um, um, a lot of things were made quite clear. [FUI97]

But the adult female in a different group thought otherwise:

> AF: And I suppose something, some voice within me was saying "Well, that was super" it obviously attracted children's attention, but maybe there should have been a bit more in the way of explanation as to exactly what was being demonstrated. [FUI42]

The adult female and her 11 year old daughter discuss how best more information might be provided in the following extract:

> AF: I'd obviously like to be able to understand what I am doing better and the principles, the scientific principles which are involved with whatever you're (.) working on or playing with.

Me: How would you like to get that information?
AF: Yes, I was just wondering how that would be (3) because you don't always want to read. You don't want to stand and read reams about it, do you?
11F: That's what I found quite boring about the Natural History Museum - you were just standing there and you read it instead of having videos or whatever.
AF: I suppose the best thing would be some kind of guide to take with you so you could read the ones you're interested in, you'd have it to take home with you with the principles explained for each exhibit, so you can follow it up and further that knowledge rather than think well, perhaps we'll understand it better by going up again. Because at the time the main thing is that they were enjoying it, that they didn't feel it was another school lesson, a booky lesson, it was quite important (.) yes they would have got bored very quickly.
11F: I hate school trips to museums. Hate. [FUI20]

The adult female in the above extract recognises that too much information could spoil the special kind of experience that Launch Pad is providing. Also it was interesting to note that many visitors who spoke of a lack of information had not made use of all the available information; for example the "bats" which gave a fairly detailed explanation or the information points. When the above group visited Launch Pad the book/guide had not been published and so was not available to them.

The overwhelming response to Question F4 "Have your feelings changed since the day of your visit?" was that they had not. The one person who thought their feelings had changed did so because they had not returned to Launch Pad as quickly as they had at first thought:

AF: Yes, that we would have gone back sooner, you know, that initially I thought oh, it's so exciting, we'll make sure we get up fairly soon and, in fact it's now quite a while. (2) So the initial excitement about it, yes, has worn off. [FUI20]

The responses to Question F5 "Did your visit prompt you to follow it up in any way?" were quite consistent, covering just a few popular themes. Most of the groups talked about the experience between themselves afterwards. This was usually on the way home or during the following few days. In the extract below the father was not in the original group but walked into the room whilst I was interviewing the mother and her two

daughters. The mother's parents were part of the original group but were not able to be present at the Follow-Up Interview.

12F: All on the train we talked about it - "It is a nice place isn't it? You should go back there. Can we go back there?" ( ) that drunk bloke.

AF: My mother used to live in London just before the war and during the war and used to spend quite a lot of time walking round the Science Museum and she was relating it to what they were doing then. She remembers the basement ( ).

Me: Did they come back and talk to you after their day out and tell you about it?

AM: Told them what a good day they had had, yeah.

12F: And you was jealous ( ). [FUI27]

The father in the following group deliberately encouraged discussion in order to make the most of the educational value of the visit:

AM: I think it was restricted to, to actually discussing things, and er, I mean we, we often talk about it. Made a, a very deep impression with us, um, we often talk about the different exhibits that come to mind, um and we try and talk to the children about them and see if they understood them by just asking them the odd quizzy question, that if they had understood it, it would have, they would know the answer, and often times I, I think they come up with the, particularly [8M], being the older one, comes up with the information. [FUI72]

About half the groups mentioned that they had also spoken about their visit to other people; particularly other members of their family, friends and teachers.

AF: Well I certainly told people about it; that I thought it was a good place to take one's children. [laughter] And it was fun and that mine had enjoyed it. [FUI42]

AM: I think we told everyone we met in the next week or fortnight that we'd been and it had been good. [FUI43]

A few visitors remarked on having seen Launch Pad on television, either before or after their visit:

10F: I remember watching 'Know How' (on television)

15F: Oh, on 'Know How', yes.

10F: I remember ( )

15F: I remember you screaming "[15F], [15F], come and look at this, this is the Science Museum".

AM: What was it?

15F: I don't remember, but talking about it and I was trying to cook my tea and it was burnt because she was screaming "Come and look at this". (3) What was it? (3) It was that lightning ball.
AM: The plasma ball.
15F: Yes, they were putting their hands on it and these kids were there and it was going all over the place. [FUI57]

Very few visitors reported making or doing something of a practical nature as a result of their visit. The adult female who saw the TIP TOE TESTER was reminded of burglars and took some appropriate action:

AF: It made me more security conscious actually. [laughs] So I decided (to get) a time switch for my ( ) to turn the lights on at night when I'm not here. [FUI29]

One 14 year old boy was so impressed by the PAPER MAKING DEMONSTRATION that he came home and made some paper himself using a tennis racket stretcher and his mother's blender:

AM: Oh yeah, I mean, we can, you know, certain things happen and let's say we have (7) if it comes up it's a situation, where we talking about how something works, and in certain cases we turn, I find that I've referred back to our visit to the Science Museum. But that's conversation. [14M] came back and made paper. We've lost a tennis racket stretcher.
Me: You've actually made some paper.
14M: Yes, except I wouldn't do it properly because I didn't have wire mesh and I'd only ever tie it and it sunk in the middle. So its, sort of like a comb ( ). [FUI31]

His parents said "he did lots of experiments anyway and he'll try anything", so this example is rather exceptional. This activity was reinforced recently as they saw a programme on children's television about paper making. The mother of this group also remarked that one of her other children, an 8 year old boy "was asking me lots of awkward questions that I couldn't answer". Overall the main response to a Launch Pad visit is one of stimulating conversation.

Question F6 "As a day out, how do you rate Launch Pad?" produced consistently high opinions such as "brilliant", "very good", "highly recommended" etc. Many of the themes which have already been noted were also mentioned. The following extracts give a flavour of the kinds of answers to this question:

9M: Ten out of ten.
7F: Twenty out of twenty, or one thousand out of one thousand! [FUI55]

AF: Well as a place to take the children I thought it was extremely good, very good, a lot better than other places we'd been and we do make a point of going to London quite a lot. [FUI70]

AF: We do thoroughly enjoy it. I wouldn't want it to be the only aspect of the thing that children did, as I wouldn't want anything to be the only aspect, I'd like them to do a whole range of things. They enjoy going to the museums, we like the Natural History Museum as well, but there again we wouldn't necessarily not want to go somewhere like Windsor Safari Park or Thorpe Park or we wouldn't want to perhaps just go and play tennis or go swimming. It's one of the things that we like to do. [FUI19]

AM: I'd say it's very good. (2) One of the most worthwhile sort of (4) stable exhibitions, what do you call it? Many other things are (3)
AF: Disappointing.
AM: Disappointing because they are, um created for tourists in a way. (2) This isn't created for tourists, it's created for people who are interested in the way things work, and I ( ) I suppose this year we also went to Madame Tussauds for the first time, just because it's there, to see what it was like, and I suppose at the end of it, we probably begrudged paying the entrance fee. [FUI43]

Parents clearly recognised the educational potential of Launch Pad and therefore rated it very highly as a day out particularly in comparison to some of the alternative more commercial venues. The previous extract emphasised the wide appeal of Launch Pad.

Question F7 "How much do you think it would be worth spending travelling in order to visit Launch Pad?" will not be analysed in detail here as it is not central to the subject of this thesis. The answers confirmed the results of the previous question by showing that families were prepared to travel quite large distances in order to enjoy and benefit from the Launch Pad experience.

The final group of questions began with G1 "How did you travel to the Science Museum?". Groups used cars, trains and tubes in a variety of combinations, with one group each using a bus and a taxi as part of their journey. 14 groups used their car for part of their journey, often to drive to the train or tube station. For many groups the

journey was complicated and not easy thus illustrating the effort that people made to visit Launch Pad.

The next Question G2 "What else did you do that day?" was designed to test how well each group remembered what they had done for the rest of their day out. All groups except one were able to state what else they had done that day, although in some cases discussion within the group was required before agreement was reached:

AF: We went round the Science Museum, bits we hadn't been round before.
8M: We went to the History Museum.
AF: We went to Natural History as well. (5) Probably went to Oxford Street, didn't we?
8M: Yes, we went to get some ( )
AF: We went to Berwick Street Market as they have some interesting, exotic fruit. (5) Did we go to High Street Ken?
8M: No. [FUI29]

There is of course no way of checking the accuracy of the groups' statements. One third of the groups (i.e. 8) stated that they went to another museum or attraction as part of their day out. A trip to Macdonalds or Pizza Hut or a picnic was a remembered part of four groups' days out. For 11 groups, Launch Pad was the sole reason for their day out.

Most people had some idea of what the weather was like in response to Question G3 "Tell me what the weather was like the day you came?", although there was often some debate about what exactly were the weather conditions at the time.

The next Question G4 "Tell me what you were wearing?" was designed to test how vivid was the overall memory of their whole day out. Almost every group had someone who had a very clear memory of what they wore on their day out:

AF: I can remember what I was wearing, actually, yes. I was wearing red corduroy trousers, (2) it was quite a warm day actually, only I had a jumper on that day.
8M: I know, was wearing this and a shirt and I think I was wearing some blue corduroy trousers.
Me: How do you remember that? It's quite a long time ago.
AF: I really don't know actually ( ). You had a jacket, I remember carrying your jacket. [FUI29]

A vivid experience in the COLOUR BOX made it easy for some visitors to recall what they were wearing:

8F: Well I just remembered what Mum was wearing.
Me: Oh really.
8F: She had a stripey jumper and animals on.
Me: Stripey jumper with animals.
AF: I've got a stripey jumper with animals on? Oh, my Clothkits one.
8F: Yes.
Me: How do you remember that?
8F: I just remembered it from the colour box.
Me: Oh, in the colour box.
AF: Yes, because my jumper would have been funny under the coloured lights.
AM: Yes, yes. [FUI35]

About one quarter of those interviewed had a clear memory of what they were wearing. Some of these memories were linked to particular circumstances, such as experience with a certain exhibit, while other visitors were unable to say why they remembered. The remainder of those interviewed were either certain they could not remember or suggested what they were most likely to be wearing based on their knowledge of what they would normally wear in similar circumstances.

Question G5 "Can you remember anything else that happened in the same week as your Launch Pad visit?" was intended to explore how visitors' memories of their visit compared to other events experienced at more or less the same time in order to assess in a qualitative way the memorability of their visit to Launch Pad. Nine groups had no recollection of any other events within a week of their Launch Pad visit. Most of the recalled events were associated in some way with their Launch Pad visit, and there was often a collaborative group effort at trying to work out what else had happened:

13F: It would have been a holiday wouldn't it?
11F: Half-term. Probably would have gone to visit (Nan and granddad), probably.
AF: hmmm.
13F: We've always had a couple of days at home. Perhaps you were at work, or something and Dad was at home. We would probably have had a couple of days.
[contd]
13F: I mean, if you're spending a day at home, you don't remember it from, it don't stand out, because, other, there's other days you spend at home, but, I mean, that was the only day, we went into

> Launch Pad, so it, sort of, sticks in your mind. The details sticks. [FUI42]

The Follow-Up Interview concluded with three questions which were designed to allow those interviewed to make any extra comments they wished:

H1 "Is there anything you would like to go back over?"

H2 "Is there anything you would like to ask me?"

H3 "What do you think of this interview?"

Half of the comments received in answer to the first question were about particular exhibits in Launch Pad; mostly about exhibits they liked, did not understand or were not working.

> 11F: Yeah, you know the plasma ball?
> Me: Mmm.
> 11F: That's something I didn't understand at all. I didn't know how it happened. I liked it, I really enjoyed putting my hand on it. [FUI92]

There were nine comments about Launch Pad and the Science Museum in general, the largest number of them about how busy Launch Pad was when they visited:

> 15F: I would like to say that, although it's fairly well laid out, I think it could do with more room.
> AM: Mmm.
> 15F: Or, it might have moved now to a much bigger space, but it needed more room, because the amount of kids in there (hanging) around the exhibits to look, there wasn't enough room. [FUI57]

Over one third of the replies to Question H2 "Is there anything you would like to ask me?" were concerned with Launch Pad and its exhibits; a frequently voiced concern, or confusion, was about the name itself:

> AM: The one thing I'd like to comment on is the name of it -Launch Pad - it's great, I mean, it, it, when you've been there you know what it refers to, that, whenever you tell someone about it - "We're going to Launch Pad" - "Oh you're going to a space museum". [FUI72]

Just over half the comments were about the interview or about me: e.g. why was I doing this research and what was my role in Launch Pad. Several people asked to see a copy

of the final report. There were also a few comments about admission charges. As with other similar comments in other parts of the interview, everyone was against them.

The final question H3 "What do you think of this interview?" prompted a number of comments half of which were very complimentary about the interview itself:

13F: It was quite fun, because it's fun to remember. [FUI42]

AF: Quite relaxing, no problem at all. [FUI44]

One mother did think it was a "little lengthy for the children" and another found it rather testing. The mother of a nine year old boy and his seven year old sister who was not part of the group because she had not been present when I first interviewed them, but sat through the FUI was clearly impressed by how much they had remembered:

AF: That's interesting, because, I mean they give the impression that they're just racing from thing to thing, ( ) turning handles, it's quite interesting how much they remembered. Like I always feel that they've gone through everything too fast and that they're just interested in doing it and running off, but they did seem to remember quite a lot. [FUI55]

The final extract in this section comes from a group consisting of a 12 year old girl and her parents. The girl says she doesn't like science - but she loved Launch Pad! Her parents explain this contradiction and, what for many visitors is one of the main attractions of Launch Pad, learning in a pleasurable way without realising it:

12F: I don't like science at all.

AM: I don't think, I don't think, this is the beauty of it - it didn't come across as an -

AF: - as science

AM: - educational thing at all, it was more of a learning thing. There's a difference between learning and education if you see what I mean, education is that you will be taught this, where as learning is something that you do yourself without any prompting at all, um, and er, I think that's the difference, is that it was, it was all very free and easy and self-explanatory, all within reason, I mean they all weren't because you couldn't understand some of them, but, er.

AF: I think, I think, you do, it was, you were being taught something without realising it, I think that that would be it, but there are things that you, like my bridge, I'm impressed with my bridge still, no I mean, you taught me something I couldn't possibly have

learned before, it's, it's, it is, it just made it. [FUI97]

8.3 Exhibit Memory Analysis

The Follow-Up Interviews contain a wealth of information about visitors' recollections of their experiences in Launch Pad. Throughout each FUI there are references to individual exhibits by each of the people being interviewed. As this study is particularly concerned with what visitors say and think about Launch Pad *exhibits* a method of sorting this diverse and scattered data had to be evolved. It was therefore decided to bring together all that one person said about any one exhibit throughout the interview, and then to précis or code it. Each précis (of what one person said about one exhibit) will be termed an *exhibit memory*.

It was decided to use a network - a device borrowed from linguists and used by Bliss & Ogborn (1977) to analyse the contents of a series of interviews with students about their reactions to undergraduate science. A network characterises the various components of

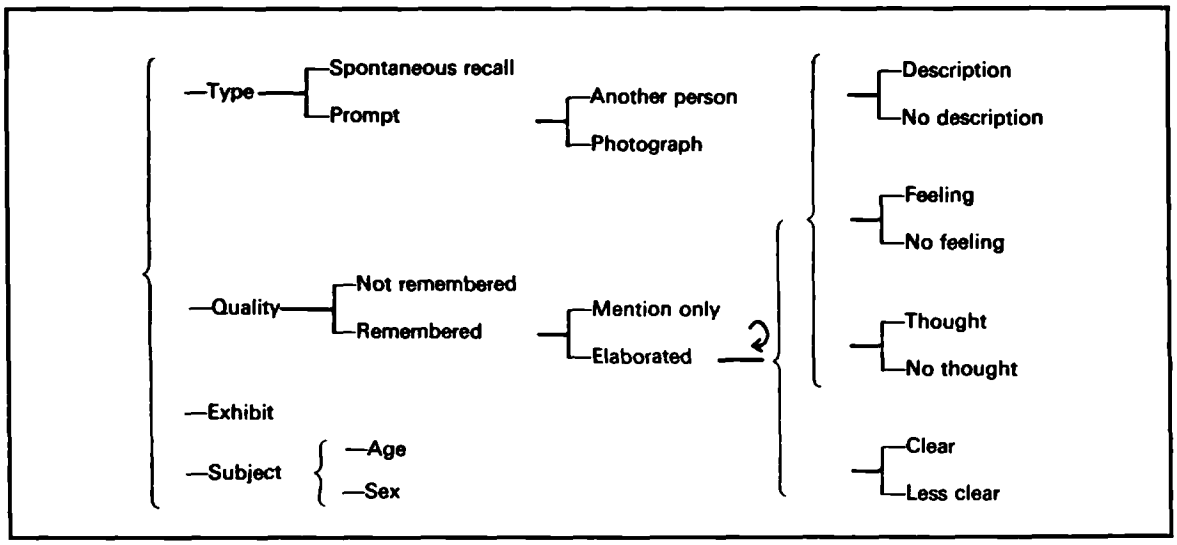

Figure 8b Network for coding exhibit memories (abbreviated form).

an exhibit memory and enables the components to be described in a general way. An abbreviated version of the final network used is shown in Figure 8b.

The network and its coding categories were evolved over a long period of time and involved many trial attempts at coding transcripts with my supervisor, Prof Jon Ogborn. The network described in this thesis was the one we considered described best the essence of the data. The categories into which the data were coded have been described using quotations as examples and I believe it would be possible to teach another researcher the exact meanings of the categories. I went through the transcripts several times, re-coding and correcting the coding in order to produce what I believe to be a fairly uniform standard of coding. It would have been best to investigate the coding reliability empirically by studying agreements of coding by independent coders. Unfortunately this was not practicable due to the large amount of work it would have required from other people. The data and its coding are of course available for inspection.

The transcripts of the interviews were marked to show those parts which were concerned with particular exhibits. Index sheets were then prepared for each person interviewed showing for each exhibit the parts of the transcript on which they mentioned that exhibit. Using the index sheets and the transcripts all that one person said about any one exhibit was coded using the network. Table N-ii in Appendix N gives the raw data on the exhibit memories from the 79 subjects given a FUI.

The total of 1699 exhibit memories from 79 subjects was stored in a database to facilitate analysis. Each subject produced on average 21.5 exhibit memories (range: 16 to 43). In this kind of analysis, people who say more carry more weight. However, no one person contributed an excessive amount. The elaborated memories were looked at in detail and these data were analysed both by subjects' age and sex, but first some general observations will be made on the data.

Each exhibit memory has a certain *quality* of recall; it may be short or long, clear or unclear, or just a negative response e.g. "I don't remember that one". The exhibit memories can be considered to have one of three qualities:

- *not remembered*

  e.g. I didn't see that one.
  I can't remember that one.

- *mention only*

  e.g. I remember that one.
  I had a go on it.
  I saw it.
  That one was working.

- *elaborated*

  e.g. I noticed that and I walked up to it and the man was there too, and I started, and I, and I put the supports in place, 'cos I'd done it before, and started building it, and he watched me, and then he started building from the other side, but he didn't say anything, but we built, and eventually we built the bridge. I walked, and I pulled out the supports and walked over it, and then (2) sort of beckoned him to have a go, and he did too. [9M/FUI55] [4]

Elaborated memories were sub-divided into two categories: *clear* and *less clear.* Memories were categorised as clear if the subject seemed positive that their recall was accurate. If their recall was of the form "I'm not sure ...." etc or their recall was obviously mixed-up (e.g. confusing two exhibits) then their recall of that exhibit was rated as less clear.

The exhibit memories data were either *spontaneously recalled* or were *prompted* either by looking at a *photograph* or by *another person* in the group talking about the relevant exhibit. Figure 8c shows the effect of *type* of memory (i.e. whether it was spontaneously recalled or prompted) on the quality of recall[5]. As stated earlier, each subject was shown 15 photographs of exhibits and this accounts for the high percentage of exhibit memories prompted by a photograph. If this type of recall is ignored then it is interesting to note that a third of the remaining exhibit memories were prompted by another member of the group.

The percentage of all the exhibit memories concerning exhibits which were *not remembered* was only 17.5% (and this does include prompting by photographs of exhibits

[4] See Appendix I for the abbreviations used in the transcripts.

[5] See Table N-iii in Appendix N for full details.

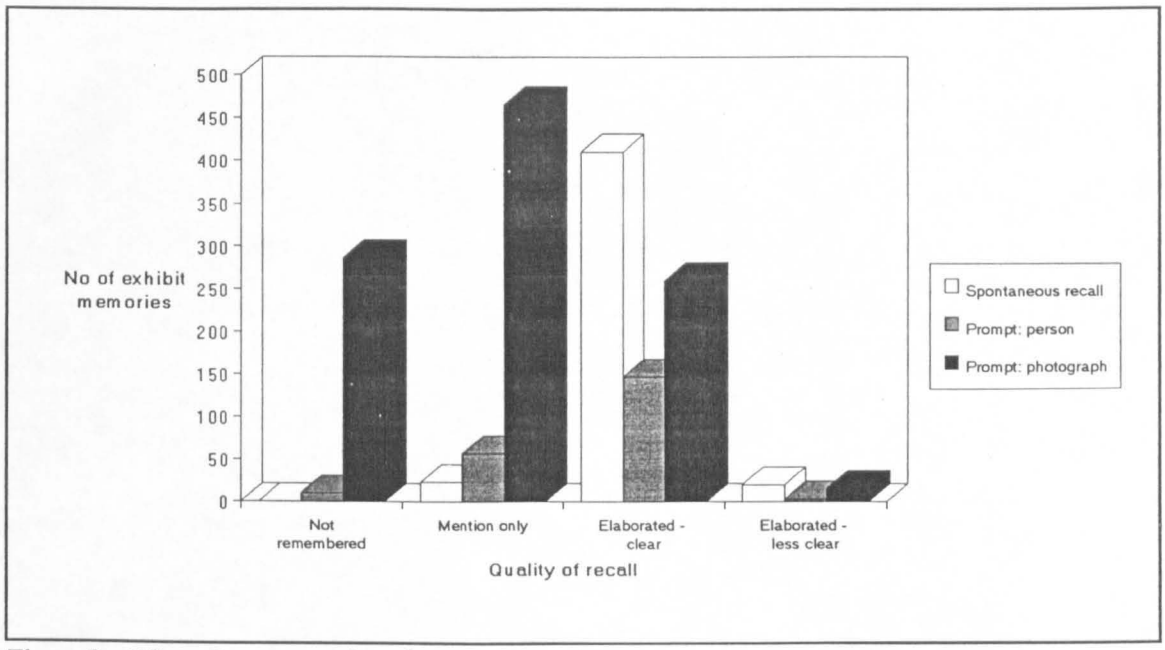

Figure 8c *Effect of type on quality of recall of the exhibit memories.*

that were not there when the subjects visited). It is of significance that half of the exhibit memories were elaborated i.e. the exhibits were remembered in some detail.

Of the 1699 exhibit memories, 453 (26.6%) were spontaneously recalled, and of these 90% were clear elaborated memories. Therefore on average, each person was able to spontaneously recall five different exhibits. Other people in the group would often prompt someone to recall an exhibit memory; of these 147 were elaborated and clear. Prompting by a photograph often resulted in just a *mention*, although 261 of the 1029 memories prompted by a photograph were elaborated and clear. Overall, nearly half of the exhibit memories are elaborated and clear, and only 2.3% of them were unclear or confused. It is not surprising that the biggest group of memories prompted by a photograph are just a mention (45%) and that only 25% are clearly elaborated. There is by contrast quite a powerful effect of reminding by another person, as 68% of the memories prompted in this way are clearly elaborated. So, being reminded by another person does not just produce "Oh yes, I remember that too." but a detailed account of an exhibit. It may be partly explained by the fact that people were going to talk about an exhibit but someone else got there first. These results are of significance as they show that visitors are able to remember clearly and in detail much of their visit to Launch Pad.

8.4 Analysis of Elaborated Memories

The earlier analysis of the views about ISTCs held by professionals working in the field in section 2.2 on page 27 resulted in three main areas of concern: activity, feelings and thought. For convenience the first three general questions are reproduced below:

1) What kinds of activity, and how much, take place and how does this affect learning?
2) How much thinking takes place during the visit and subsequently?
3) How do visitors react emotionally to the exhibits during their visit and how do they feel about them afterwards?

The fourth question was on attitudes. My research was not designed to investigate changes in attitudes, although there is data which gives an idea of what visitors' attitudes are like after their visit.

The Follow-Up Interview was designed to elicit comments about the exhibits, and Launch Pad itself, from groups of people who had visited about 6 months previously. Comments on particular areas were not solicited; the groups were asked to talk about the exhibits and they were free to comment on whatever they wanted. This freedom of response evidently resulted in a mass of data which is largely disorganised and unstructured. Looking at the data it became apparent that the data could be organised in a way which reflected the structure of the professional views. Visitors did comment on what they did with the exhibits, what they felt about them and what they thought about them.

It is valuable, or at least very convenient, if the professional views and visitors' comments can be organised in the same way. Comparisons can then be made between what is expected and what actually happens. Therefore the exhibit memory data were analysed reflecting the broad structure of the professional views. After studying the data and trying out several versions of possible schemes, the scheme which will be described next appeared to work best.

The elaborated category of exhibit memories were looked at in three broad aspects:

- descriptions
- feelings
- thoughts

Descriptions are pragmatic accounts of what the subject did with the exhibit or of the exhibit itself. Examples of descriptions are:

8M: There was these bricks things and there was this boat - sort of a boat about that long - and you got to make it higher enough and long enough so the boat can go under. [FUI19]

15M: Apart from the Air Engine. A wheel refused to go past a certain point without you helping it with your hand. [FUI70]

AF: The thing where you have to trail along on the carpet and you set off an alarm. [FUI43]

Feelings are accounts which contain sentiments such as enjoyment, surprise, annoyance, dissatisfaction etc. Exhibit memories coded as feelings are:

AM: It was quite amazing watching it shoot up into the air. [FUI40]

15F: It was rather clever ..... I enjoyed it. [FUI57]

AF: I was amazed! ..... I was impressed. Surprised by it. [FUI97]

Thoughts were statements containing evidence of thinking or reflecting about the exhibit in some way. For example, a subject may have tried to explain what the exhibit was all about, related it to something they already knew or remarked that they could or could not understand it. Memories coded as thoughts are as follows:

AM: I couldn't really understand, but then, perhaps I didn't read it much ..... I mean I understand that if there's acid in your body you act like a battery, but it wasn't really. I thought it could be explained a bit more. [FUI36]

8M: I can't work out how they work. [FUI72]

AF: It was like one of those bubble lamps, wasn't it, where the bubbles go elongated and strange shapes. [FUI101]

14F: I understand that bike one - you light up the lights. It's to do with how fast the wheel goes round, makes the lights light up, the more friction you get up, the more lights you light up, the more power you're getting. [FUI101]

Since an exhibit memory consists of all that a subject says about a particular exhibit during the whole interview, an exhibit memory can be more than one page of transcript in length and can include more than one description, feeling or thought. It was common for an exhibit memory to consist of two or three separate descriptions, feelings or thoughts. No memory, however, contained more than three descriptions, three feelings or three thoughts.

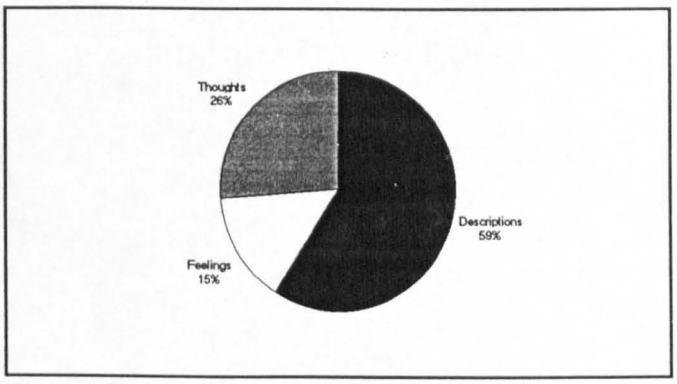

Figure 8d *Main categories of elaborated exhibit memories.*

There were 857 elaborated exhibit memories containing 1438 separate comments (i.e. a description, feeling or thought). Figure 8c shows how these separate comments were divided into descriptions, feelings and thoughts. Full details are given in Table N-iv in Appendix N.

It is perhaps not surprising that 59% of the comments are descriptions. However, it is interesting to note that there are nearly twice as many thoughts as feelings. Popular views of ISTCs tend to emphasise the enjoyment of the experience and to be concerned at a suspected lack of thought, reflection or learning: this is not reflected in the exhibit memory data.

Figure 8e shows the very clear differences which the prompt has on elaborated memories. Spontaneous recall, and reminding by a person, produce about 50% more thoughts than reminding by a photograph. Spontaneous recall also produces about twice as many feelings than either photograph or person prompted memories. Nearly three quarters of photograph prompted memories were descriptions. Also, the average number of separate comments from a spontaneous recall is four times greater than that of a person prompted memory and two and half times greater than that of a photograph prompted memory. Overall, the data suggests, not unsurprisingly, that spontaneous recollections are more

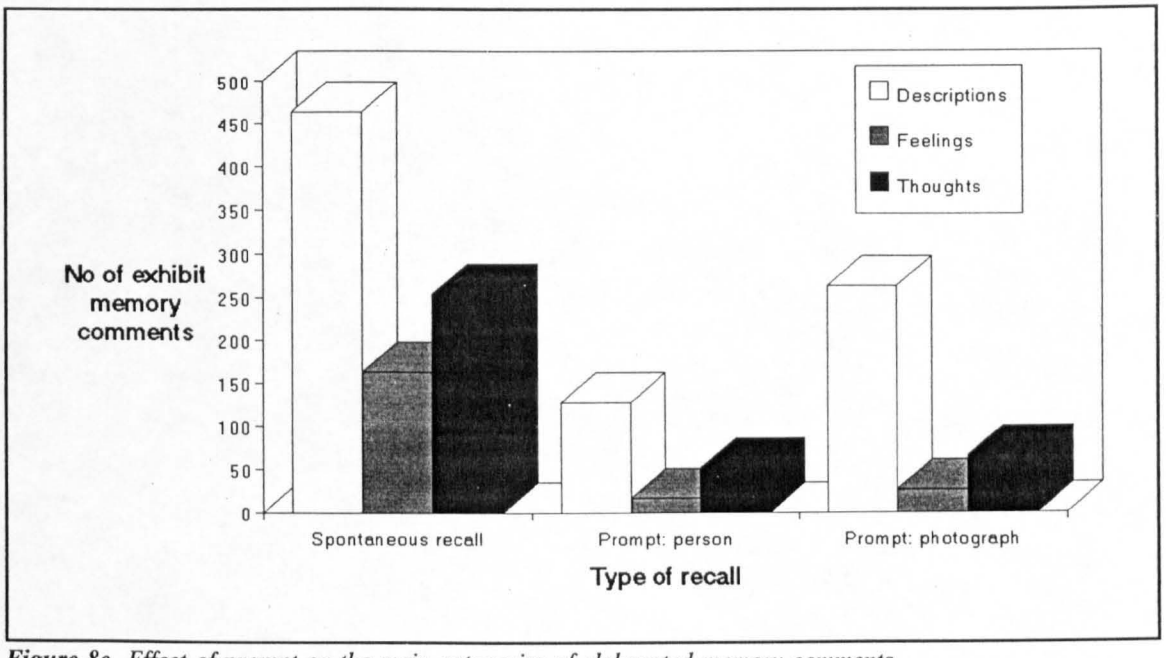

Figure 8e *Effect of prompt on the main categories of elaborated memory comments.*

varied and have more *depth* than others.

The following three sub-sections look in detail at each of the three aspects of exhibit memories: descriptions, feelings and thoughts.

8.4.1 Descriptions

Study of the data suggested that descriptions were concerned mainly with either features

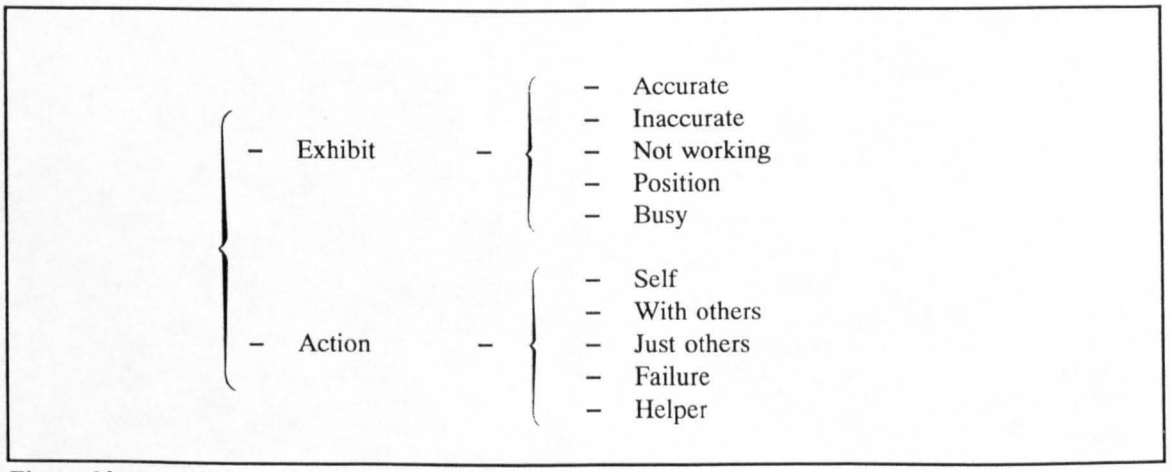

Figure 8f *Network for coding exhibit memory descriptions.*

of the exhibit itself or what the subject, or others, did with the exhibit. For analysis, each of these two categories were sub-divided as show in Figure 8f.

Descriptive comments about an exhibit were placed in one of the following subdivision:

(a) an accurate physical description of an exhibit,

(b) an inaccurate description,

(c) a comment about an exhibit which was not working,

(d) a comment about an exhibit which was so busy that the subject could not get a go or had to wait a long time.

Descriptive comments about the actions of the subject, or of others, were placed in one of the following subdivisions:

(e) actions of self,

(f) actions of self with others,

(g) actions of just others,

(h) actions which failed i.e. could not get it to work,

(i) actions involving a helper.

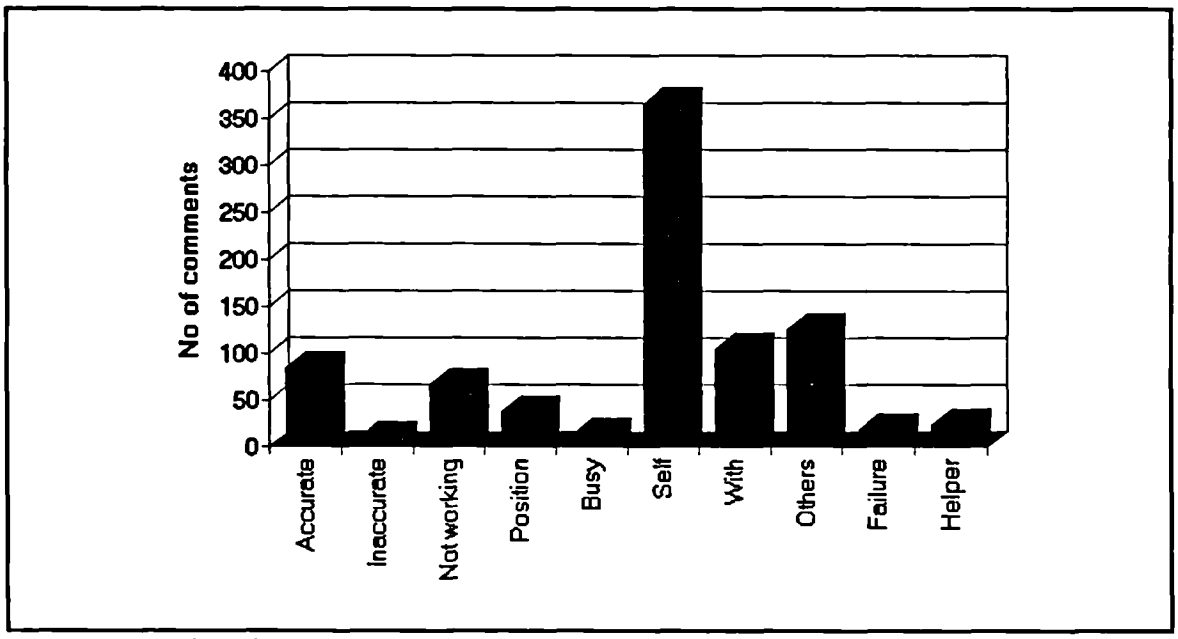

Figure 8g Details of descriptive memory comments.

Details of the results from the analysis of the descriptive comments are given in

Table N-v in Appendix N. There were three times as many comments about actions as exhibit descriptions, and Figure 8g shows clearly that 43% of all descriptive comments were about what the subject had done with the exhibit. Twenty seven percent of the comments were either about what the subject with others had done or about what they had seen others do. The fact that 70% of the descriptive comments were to do with actions confirms the view that a lot of hands-on activity takes place, and it is this activity which is remembered.

It is encouraging to note that only 2% of comments were about a subject experiencing failure in some way at an exhibit, and that only 2% commented on not being able to get a go on an exhibit. However, it is disconcerting that 8% of the comments were about exhibits which were not working. This suggests that broken exhibits (or ones which do not appear to work) are more memorable than ones which work as on average only 5% of the exhibits were not working at any point in time. This result is however in agreement with the practical experience of the running ISTCs. There were also 8% of comments concerning the position of an exhibit; this was usually expressed by describing an exhibit as near another, or by saying that an exhibit was in a certain part of the gallery.

The accurate exhibit descriptions outnumbered the inaccurate one by ten to one. After an interval of at least six months between the dates of the subjects' visits and subsequent interview, this result suggests that the initial impact of Launch Pad must have been high in order to generate such distinctive accurate memories.

8.4.2 Feelings

Comments about feelings were coded as either positive or negative, and both of these broad categories were subdivided as shown in Figure 8h. The words in brackets indicate some of the most popular words subjects used which were coded and included in that particular category. Full details of the results are given in Table N-vi in Appendix N.

Of the 208 comments on feelings, 73% were positive. Categories which attracted the

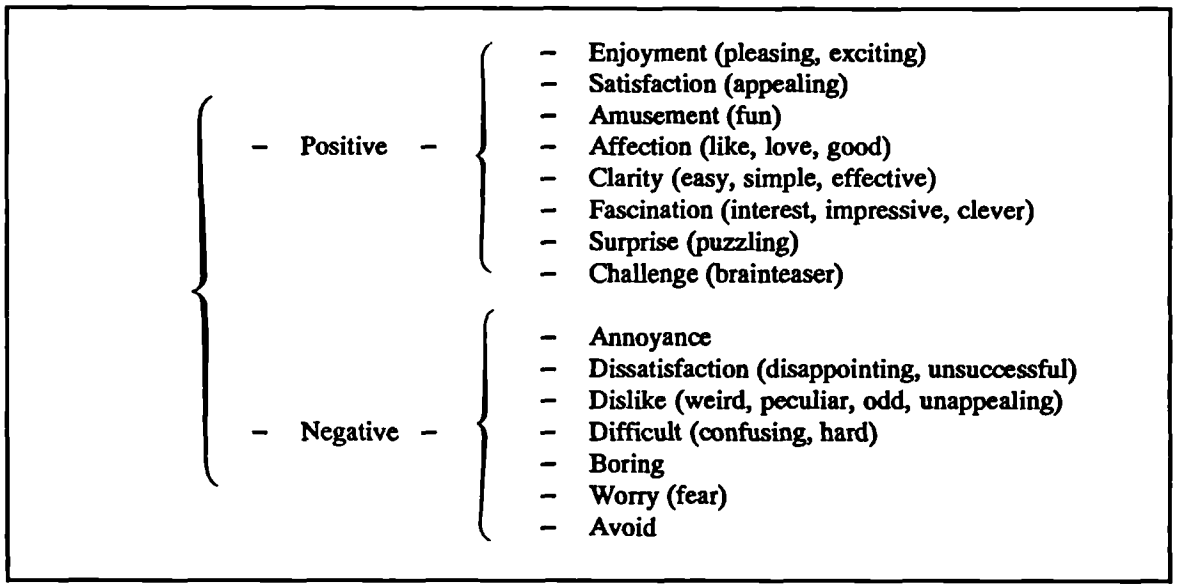

***Figure 8h** Network for coding exhibit memories on feelings.*

most comments were Fascination, Amusement and Enjoyment, whilst Avoid, Satisfaction and Worry attracted the least.

In order to make the analysis simpler, and as some of the numbers are small, the data was collapsed to form 6 categories: Pleasure, Clarity, Wonder, Displeasure, Difficulty and Misgiving (see Figure 8i). These data indicate that visitors' feelings comments about the

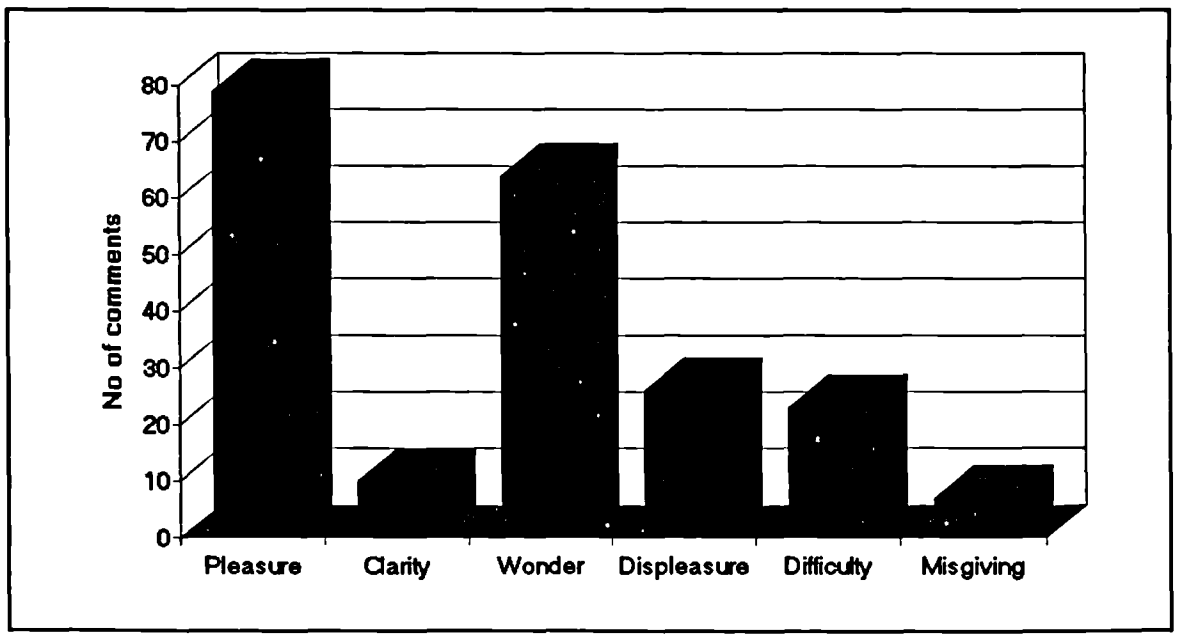

***Figure 8i** Details of feelings memory comments.*

exhibits are mainly pleasurable and full of wonder. Only 3% of these comments were concerned with visitors' misgivings about the exhibits. Overall, these results are encouraging for ISTCs as they are generally positive.

8.4.3 Thoughts

There were 375 comments on thoughts about the exhibits, which were divided into categories concerning explanations, effects, applications, related things, learning and

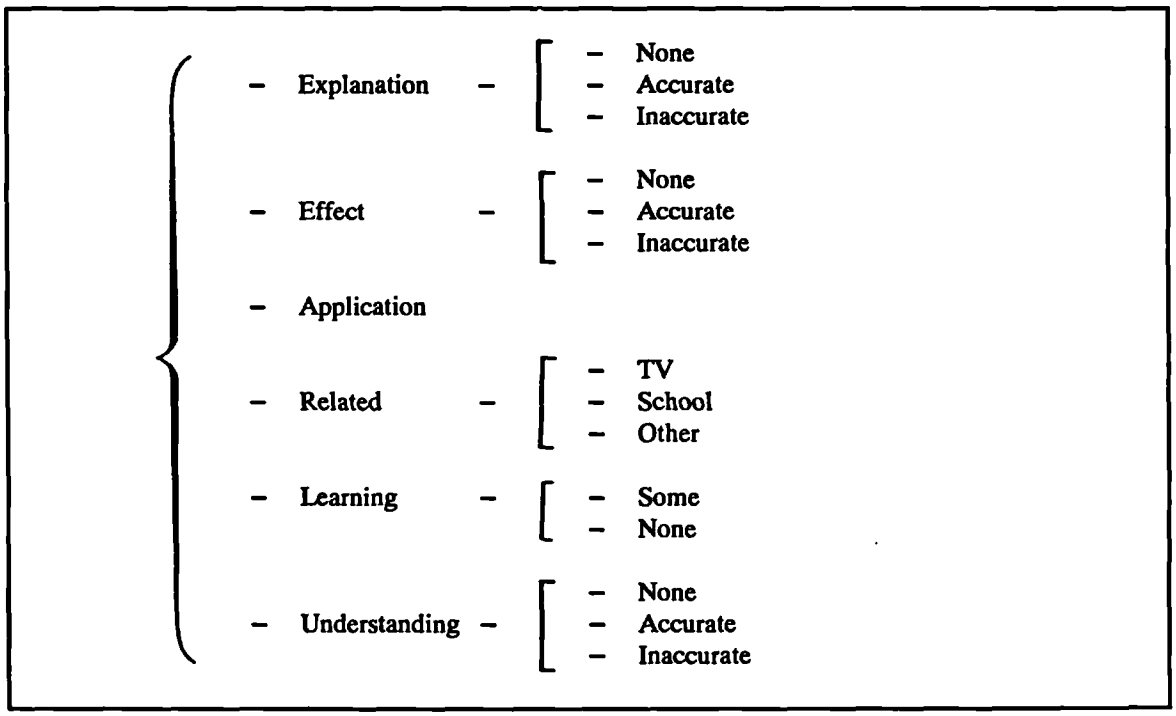

Figure 8j Network for coding exhibit memory thoughts.

understanding. Most of these categories were subdivided as shown in Figure 8j. The subdivision "none" contains those comments of the form, "I did not understand it." and "I could not see what it was all about.". If the subject went into a detailed description of an explanation or their understanding of an exhibit then that description could assessed for its accuracy. If the statement was of the form "I understood that one." then it was assumed that their understanding, explanation or effect description was accurate. As stated previously, no attempt was made to assess whether subjects were able to describe what effect the exhibit was trying to show, provide an accurate explanation or give

evidence that they understood it. These categories are therefore the result of what the subjects themselves chose to talk about.

The full results of coding the comments about thoughts are given in Table N-vii in

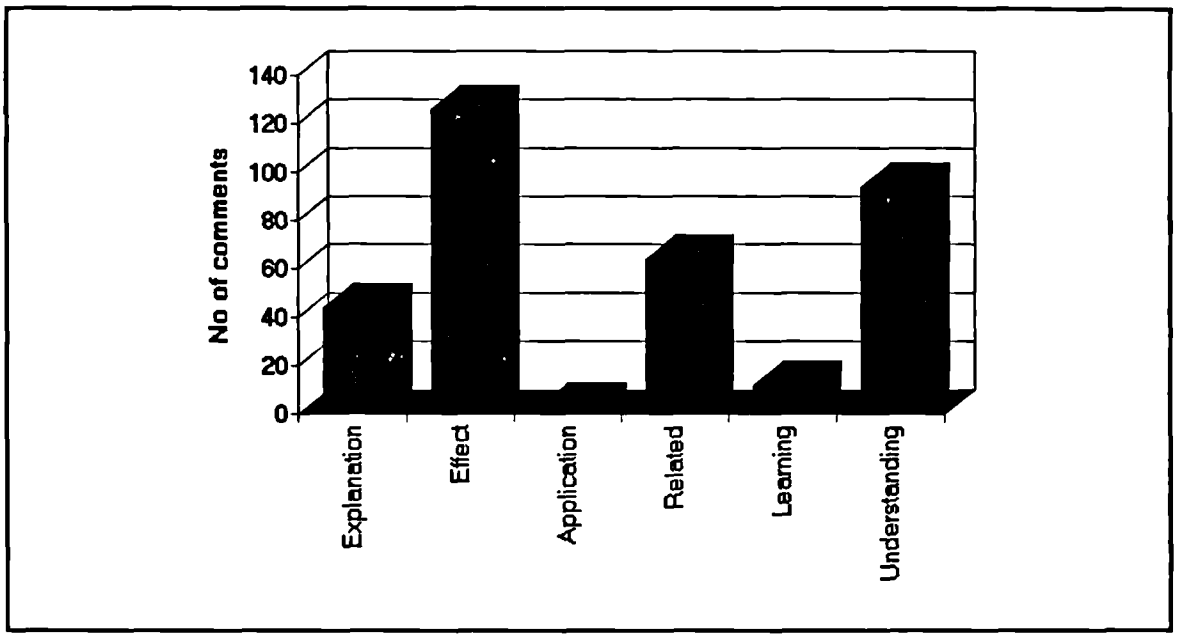

***Figure 8k** Details of thoughts exhibit memories.*

Appendix N. Figure 8k shows the distribution of comments among the main categories. The category with the largest number of comments was Effect, and of these comments 90% were assessed as accurate. It is reassuring that subjects were able to recall accurately an effect they had noticed over six months previously. The next largest category was Understanding, although only 27% of these were assessed accurate; most of the understanding comments were of the form "I did not understand it.". All except one of the 86 related comments were related to something relevant. Of the 44 Explanation comments, 57% were assessed as accurate. There were a large number of comments which related the exhibit to something relevant which the subject may, for example, have seen on television or come across at school. A few comments were made on learning from the exhibit being talked about; 75% of these were positive and that people would learn something from the exhibit even if it was subconscious.

The main conclusion to be drawn from this analysis is that visitors do think about the

exhibits. The evidence from the thoughts comments, particularly the "related" ones, suggests that cognitive processing does take place both during and after the visit.

8.5 Exhibit Memory Analysis by Age and Sex

Exhibit memories have been defined as having *quality* - an indication of how elaborate or extensive the memory is. Figure 8l shows how the quality of exhibit memories varies

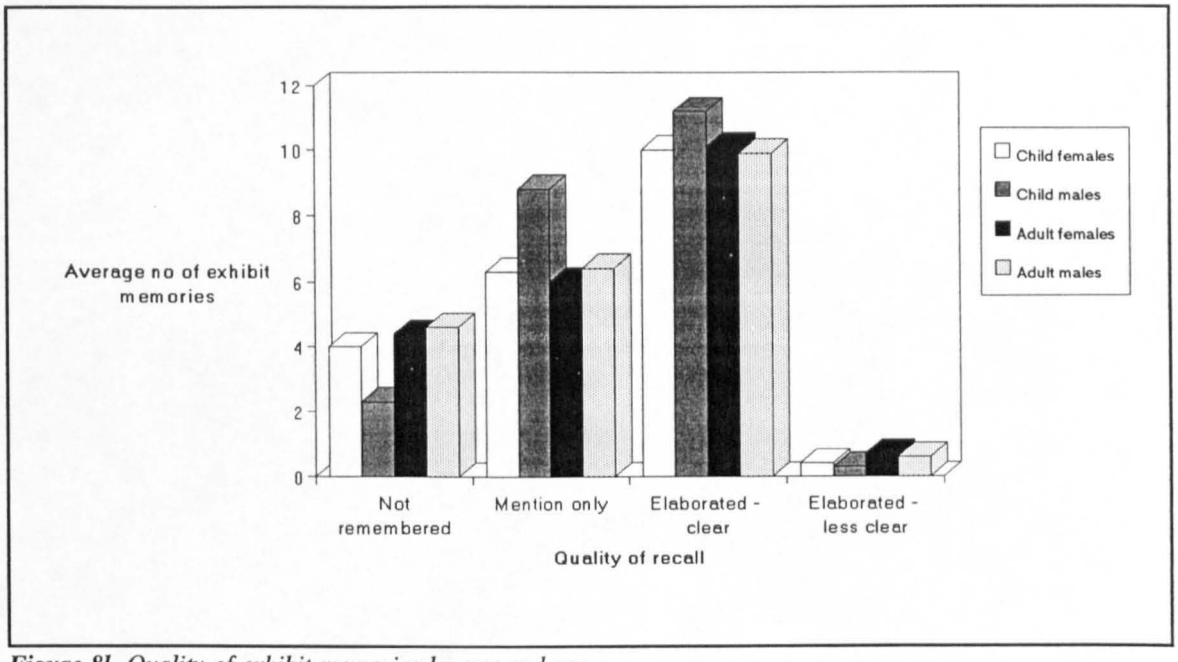

Figure 8l *Quality of exhibit memories by age and sex.*

between males and females, and between adults and children[6]. There is apparently no difference in the quality of recall across age or sex, except perhaps for male children. The data suggest that boys mention about 30% more exhibits and do not remember only half as many exhibits as girls or adults.

Exhibit memories were either recalled spontaneously or were prompted, by a photograph or by another person talking about an exhibit. Figure 8m shows how the type of recall

[6] See Table N-viii on page 307 for full details.

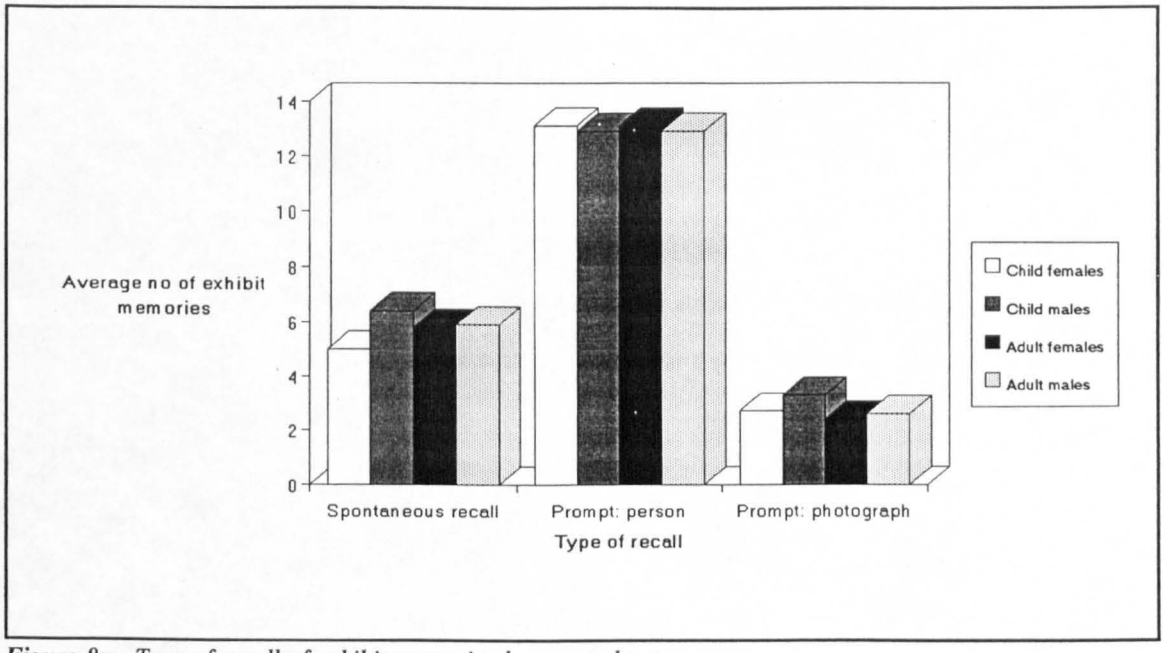

Figure 8m *Type of recall of exhibit memories by age and sex.*

of an exhibit memory varies by age and sex[7]. There is clearly no difference between male and female adults, although there appears to be some difference between boys and girls. Overall, boys are marginally more likely to spontaneously recall an exhibit than girls, and to respond to another person talking about an exhibit. Perhaps this suggests a certain eagerness of the boys to respond positively.

Apart from these few differences children and adults, and males and females, seem to respond to prompts in the same way. Children tend to produce more recollections than adults when the prompt is a person, and also more of their recollections are clearly elaborated.

The three broad aspects (descriptions, thoughts and feelings) of elaborated memories have been analysed by age and sex. The results are shown in Figure 8n. The data suggest that there is very little difference between males and females but that there are small but noticeable differences between adults and children. Each adult and child on average recalled about 11 descriptive elaborated memories, but adults recalled on average over 60% more elaborated memories concerned with feelings and about 40% more concerned

[7] See Table N-x on page 308 for full details.

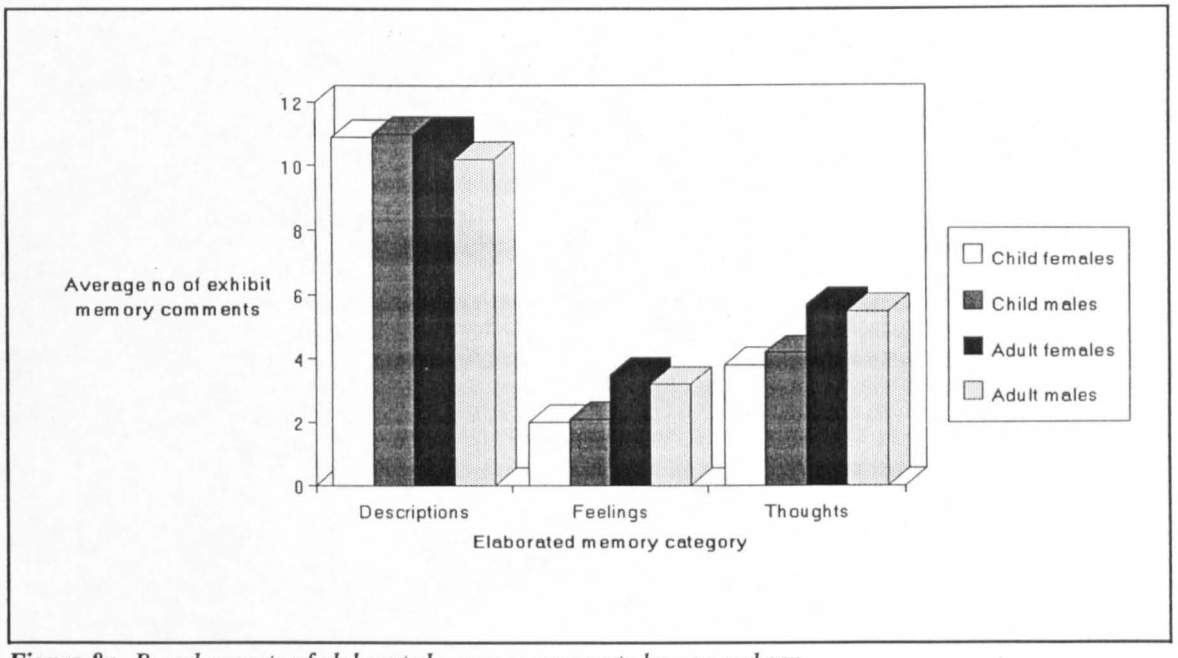

Figure 8n *Broad aspects of elaborated memory comments by age and sex.*

with thoughts.

The data were further analysed by age, and Figure 8o shows the average number of

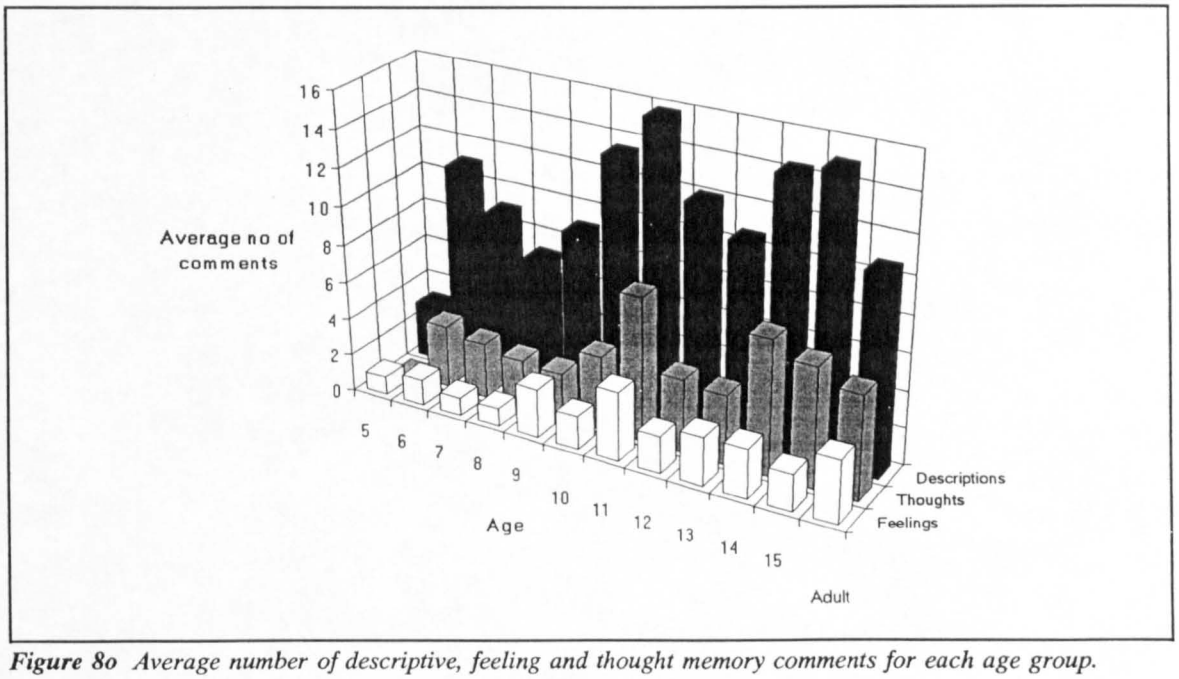

Figure 8o *Average number of descriptive, feeling and thought memory comments for each age group.*

descriptive, feeling and thought comments made by each age group. As the sample sizes are small, it would not be sensible to place too much reliance on the data. However, it

seems that some general conclusions can be drawn.

The 79 subjects made 854 descriptive memory comments (i.e. average of 10.8 comments per person; range: 3 to 25). It appears that adults and children produce the same number of descriptive comments. As mentioned previously, adults produce more comments on feelings and thoughts than children.

There were 209 comments on feelings from 79 subjects (i.e. average of 2.6 comments per person, range: 0 to 8). It is interesting to note that eight children (6M, 6F, 6F, 8F, 8F, 8F, 9F, 10F) made no feelings comments.

There were 375 memory comments on thoughts (i.e. average of 4.7 comments per person; range: 0 to 13), and five young children (5M, 6F, 9M, 9F, 10F) made no comments on thoughts.

8.6 Conclusion

The Follow-Up Interviews produced a wealth of data which have shown how detailed, vivid and clear are visitors' recollections of Launch Pad many months after their visit. Much information about the exhibits was collected and analysed which shows the complexity of visitors' behaviour with the exhibits and each other, both during the visit and subsequently. After much effort a new and successful way of sorting this diverse and scattered data was evolved by the development of a network and coding categories.

This analysis of the large number of exhibit memories showed, for example, that 97.3% of them were clear and accurate, and that spontaneous recollections were more varied and had more depth than others. It was found that the elaborated memories could be looked at in three broad aspects: descriptions, feelings and thoughts. Although 59% of the comments were found to be descriptive, there were nearly twice as many thoughts as feelings. This suggests that the concern of some that ISTCs emphasise enjoyment at the

expense of lack of thought, reflection or learning is not supported by this data.

Nearly three quarters of the comments on feelings were positive. The analysis of the comments on thoughts showed that visitors were able to recall accurately an effect they had noticed previously. The data also showed that subjects had reflected on their visit, relating their experiences to existing knowledge or to programmes they had seen on television.

The data suggest that there is little difference between males and females but that there are small but noticeable differences between adults and children, which is encouraging news to those who hope that ISTCs provide equal opportunities for both genders.

CHAPTER 9 CONCLUSIONS

9.1 Introduction

Throughout this thesis questions have been raised concerning the immediate and long-term impact of Launch Pad on its visitors, and expectations of what might happen have been collected. In this chapter, a brief summary of the relevant evidence collected in this study is given for each question or expectation. Also, questions relating to the particular memory aspect of this study are considered.

Then, starting from the views of professionals, the results of this study will be used to assess whether Launch Pad is achieving its goals or not. This will give an opportunity to provide an overall review of the research.

Finally, the results of this research and a consideration of the questions which still need an answer are used to suggest profitable areas of further study.

9.2 Research Questions

At the end of Chapter 2, a series of questions which this research might address were listed in four main categories:

- behavioural: What do family groups do in Launch Pad?
- cognitive: What do they think about Launch Pad?
- affective: How do family groups react emotionally to their visit?

- attitudinal: What differences to attitudes result from a family's visit to Launch Pad?

The individual questions within these categories will now be addressed.

9.2.1 Do visitors spend significant amounts of time looking at and interacting with exhibits?

One of the most striking conclusions of the analysis of the tracking data in Chapter 5 is that Launch Pad does hold the attention of its visitors. Of the total amount of time spent in Launch Pad by all the 20 tracked subjects, four fifths (78.9%) was spent either interacting with or observing the exhibits.

9.2.2 How much attention do they pay to their surroundings?

It follows from the above paragraph that visitors spend very little time paying attention to their surroundings; only 2.9% of visitors' time on average appeared to be spent not paying attention to the exhibits. When moving from exhibit to exhibit (which occupied 18.3% of the total time on average) visitors appeared to be actively looking and deciding which exhibit to try next.

9.2.3 Is their behaviour different at different exhibits?

There are marked differences in visitors' behaviour at the 68 exhibits in Launch Pad as detailed on page 100. Various indicators such as ***Overall Popularity***, ***Observed Popularity***, ***Interactivity***, ***Return Appeal*** and ***Follow-Up*** were defined and show considerable variations from person to person and from one exhibit to another. A high score on one indicator does not necessarily mean a high score on another. The introduction and illustration of the concept of Exhibit Profiles - see page 107 - shows this wide variation and that each exhibit has a distinctive character of its own. Although some exhibits are more popular than others there appear to be no ideal exhibits which

would appeal to everybody.

9.2.4 What differences in behaviour are there by age and sex within the group?

There are variations in visitors' behaviour as illustrated by the definition and use of indicators such as ***General Involvement, Variety, Attention Span*** and ***Hands-On*** as given on page 100 and following pages.

Overall, there were few differences in behaviour between the sexes, although differences according to age were detected as detailed in Chapter 5 and summarised on page 102. Children spend approximately twice as much time interacting as adults, and adults spend more time observing, although children do spend more time in total observing and interacting with the exhibits.

9.2.5 How much social activity takes place?

This research study was not designed to answer this question specifically although the data collected and informal observation suggest that a visit to Launch Pad is a social occasion. Groups do tend to stick loosely together whilst in Launch Pad although children are more likely to interact with strangers at an exhibit than adults. Comments from the Follow-Up Interviews in particular show that family groups who had visited found it to be an enjoyable and worthwhile social occasion.

9.2.6 Does the group's behaviour change during their visit?

As the analysis of the tracking data in section 5.2.2 showed, there is little variation in behaviour over the time of a visit thus indicating that visitors are not subject to *museum fatigue* in Launch Pad.

9.2.7 Are there characteristics of exhibits which, for example, make them popular or unpopular?

As explained in 9.2.3 above, some exhibits are more popular than others but as the indicators ***Impressiveness*** and ***Rememberedness*** (defined on page 122 and page 136 respectively) show, visitors choose a wide range of exhibits when asked to state the exhibit which impressed them the most or which they remember best. The data collected in this thesis suggest that there are no simple features or characteristics which guarantee popularity to an exhibit.

9.2.8 During their visit do they think about what the exhibits are all about?

Whilst in Launch Pad visitors spend a large proportion of their time attending to the exhibits and the results from the Follow-Up Interviews indicate that this is not mindless activity. Of the elaborated memory comments, 26% were concerned with thoughts. Although the data suggests that this thinking is not particularly deep or full of understanding, it is clear that visitors *do* think about the exhibits during their visit.

9.2.9 Do they remember the exhibits? If so, how and about what?

The Follow-Up Interviews described in Chapter 8 contain much talk about the exhibits in Launch Pad. In fact, about 70% of each interview is concerned with the exhibits. Visitors can recall in vivid details what they, or others, did with an exhibit, what they thought about it and how they felt about it.

In the Follow-Up Questionnaires 98% of visitors reported that they had talked about the visit to someone afterwards. No tracking data was specifically recorded on the conversation of subjects.

9.2.10 Do they try to explain the exhibits?

The evidence from the Follow-Up Interviews suggests that visitors, particularly adults, are concerned with finding an explanation or understanding the exhibits as 40% of their exhibit memory thoughts were about explanations or understanding. However, it should be noted that nearly 60% of these thoughts were about an inaccurate or lack of understanding or explanation. General remarks made during the FUIs by some visitors show that adults would like to have explanations so that they could pass them on to their children. The "bats" which provide explanations were frequently overlooked.

9.2.11 Do they relate the exhibits to what they already know?

Visitors are able to relate accurately their experiences of the exhibits to relevant experiences, usually programmes on television or lessons at school. Of the exhibit memories on thoughts, 23% were in the related category.

9.2.12 Do they think about it afterwards?

As mentioned in section 9.2.9 above, 98% of those responding to the Follow-Up Questionnaire had talked about their visit, indicating that visitors do think about their experiences afterwards. Comments from the Follow-Up Interviews suggest that prompts (such as something on TV) can prompt thought about an exhibit.

9.2.13 How much do they learn?

The data collected cannot answer this quantitative question, although it is apparent that they learn something. Immediately after their visit, 55% of subjects stated that they had learned something from the exhibit which had impressed them most. From the Follow-Up Interviews it was clear that many subjects felt that their learning had been an enjoyable experience.

9.2.14 What emotional responses do visitors have to their exhibits?

Visitors' comments on their feelings about the exhibit are varied as shown by the responses to the Post Visit Interview and the Follow-Up Questionnaire. Their comments in the Follow-Up Interviews were analysed and show that the main feelings visitors have about the exhibits are to do with pleasure and wonder. Only 27% of exhibit memory feelings were coded as in any way negative, and most of these were of the form "I didn't like that one." or "That one was hard.". General remarks made by visitors in all the interviews and questionnaires showed an overwhelming positive response to Launch Pad itself.

9.2.15 Do these responses vary from exhibit to exhibit?

This research has shown clearly that the exhibits do evoke different responses from visitors. Adults and children are sometimes attracted by different exhibits, and there are some differences between the sexes, but overall the differences appear to be quite individual. The various indicators which have been introduced throughout this thesis show the very complicated set of differences that exist amongst the visitors. A consequence of this is that practically every exhibit is a favourite with at least some visitors.

9.2.16 What responses do visitors have to Launch Pad as a whole?

Throughout this study, visitors made large numbers of positive and encouraging statements about Launch Pad, believing their experiences to be both enjoyable and of educational benefit.

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9.2.17 Do they find it an inspiring experience?

It is difficult to give a precise answer to this question. My impression is that some visitors did find it an inspiring experience. It would be interesting to interview the children in about 15 years time to see whether more of them than one might expect had

chosen (or been inspired to choose) a career in science and technology. To answer this question properly a different study from this one is required.

9.2.18 Do their reactions change over a long time?

Very little evidence was found to suggest that visitors' reactions to or feelings about Launch Pad changed over time. Visitors stated almost unanimously that their feelings had not changed since their visit. Also, as less that 5% of visitors' memories were rated as inaccurate their memories also remain intact for a long period of time.

9.2.19 Are they more "turned on" to science and technology?

From this study it is not possible to provide any quantitative answers to this question. From the general comments made by subjects in the FUIs it is clear that adult females in particular, who often had had no formal training in science or technology, had found Launch Pad to be not only non-threatening but also that its environment was one in which they discovered they could learn about science - a subject they previously could not approach.

9.2.20 Do they follow up any of the interesting things or effects they may have seen?

This study has shown that practically every visitor follows up their visit by at least talking about their experiences, and recommending Launch Pad to others. Very few visitors reported taking part in any practical follow up activities.

9.3 Launch Pad and Memory

This study support the results of psychological research into everyday memory. Subjects' recall of their experiences in Launch Pad has been shown to be accurate, vivid and detailed, and this is apparently due to their distinctive and pleasurable nature. For most people, Launch Pad is an unusual place and their experiences with the exhibits often

involved unique actions, which helped to make the visit memorable. One slightly surprising result was that subjects often vividly recalled the actions of others, whereas it is usually the case that if a person is at the centre of the action then the experience will be better remembered.

It should be remembered that most of the memories recalled were prompted by general questions of the "Tell me about it." kind in order to encourage the spontaneous recall of subjects' experiences. If a more direct or in-depth questioning technique had been adopted then even more detailed memories might have been recalled.

9.4 Professional Views

In section 2.2.1 I described what professionals have said they hope to achieve with ISTCs, i.e. their aims and objectives. What professionals think actually happens in an ISTC and what they think are the after-effects of a visit are described in section 2.2.2. The results of this thesis have shown that many of these aspirations are well founded.

It has been shown that there is a lot of hands-on activity, and also group activity. There is much observation too, and no evidence was found of children rushing mindlessly from one exhibit to another. Visitors reported overwhelmingly that their experiences of Launch Pad were enjoyable and educational. Children and adults stated that they had found science to be accessible and non-threatening in Launch Pad - something which several remarked that they had not found to be so in their experience of science at school.

Little reading of labels was observed to take place, and this thesis is unable to settle the debate as to what extent helpers create an atmosphere in which learning can take place. Visitors talked of a wide range of affective responses to the exhibits, mostly positive although some vivid memories were associated with negative responses such as failure.

This thesis has established that visitors do take away a large, vivid and detailed set of

experiences[8] of their visit consisting of what they did, how they felt, and what they thought. They also take away many *effects*, for example, noticing that a person goes slower when leaning out whilst spinning on the TURNTABLE. However, they take away much smaller sets of *explanations* and *applications*, although visitors are able to relate their experiences to what they already know and to what they learn subsequently.

It has not been possible to quantify a visitor's increase in understanding resulting from a visit, although the data suggest that visitors do come away with the feeling that they understand more. Visitors' attitudes to science and technology have been found to be generally positive after their visits, although this study was not designed to investigate changes in attitude.

9.5 Launch Pad and its Aims

The aims for Launch Pad were stated on page 22. I believe that the results of this thesis show that Launch Pad *is* a place where people of all ages discover that exploring and experimenting in technology can be a satisfying and worthwhile experience. The experience is also subtly educational; visitors learn without being aware that they are learning. As stated previously in section 9.2.17, a separate study is required to find out how inspirational Launch Pad is for young people and whether they are encouraged to pursue technology and science further. My impression is that some visitors had found their experience to be an inspiring one.

9.6 General Conclusions

Interactive Science and Technology Centres endeavour to improve the public understanding of science and technology by enabling exploration of scientific principles,

[8] See page 32.

giving explanations and providing enjoyable and inspiring experiences to their visitors. It is hoped to achieve all this by allowing visitors to interact both physically and mentally with the exhibits. Also, it has often been argued that one of their main advantages is that they provide first-hand experience of the *real thing*, and that this promotes learning.

The results of this study show that this view is well founded. ISTCs (Launch Pad in particular) do provide a rich and highly memorable set of substantial experiences on which understanding can be built. Considering the relatively short time which visitors spend in Launch Pad, and the very short times which visitors attend to each exhibit, it is surprising but pleasing to see how much visitors remember of the exhibits themselves and what they are all about. The vivid detail of visitors' recollections of their experiences over six months after their visits is a clear indication of the long-term impact of interactive science exhibits.

Comments from subjects, as expressed in the FUIs, indicate as Launch Pad inspires and motivates children to explore and handle the exhibits, that overall they view it as an enjoyable interactive educational experience rather than a giant fun-fair. Adults view Launch Pad as a place where children can interact with the exhibits and find out things in an enjoyable way. Both adults and children felt strongly that Launch Pad was a place which set them thinking.

This research has also shown clearly that visitors do talk about their experiences after their visit and relate them to, for example, programmes they watch on television. By recalling their experiences visitors are helping to reinforce their memories. This subsequent cognitive processing is an important part of an individual's attempt to make sense of the perhaps initially confusing and baffling experiences. By relating their experiences of Launch Pad to other experiences and to their knowledge of the world in general, visitors can come to a better understanding of scientific and technological principles.

It was not unsurprising to find little direct evidence of learning from this study whilst

visitors were actually in Launch Pad. However, the data suggest that the rich and varied experiences acquired in Launch Pad do provide a substantial foundation upon which subsequent learning and understanding can be based.

In general, few differences were discovered between the behaviour or recollections of males and females, although differences were found between adults and children.

9.7 Further Study

New ways of describing exhibits, and visitors' behaviour with exhibits, have been created and defined in this thesis. These include the definition of indicators (such as ***Hands-on***, ***Return Appeal*** and ***Popularity***), the creation of the concept of an Exhibit Profile and a new graphic way of representing the essential characteristics of interactive exhibits. These new ways present opportunities for comparisons to be made between ISTCs and between similar exhibits in different locations. For example, it would be possible to compare visitors' reactions to AIR JET when it is in Launch Pad to its placement say, in a traditional gallery in the Science Museum. This would help to resolve the debate of the effectiveness of stand-alone interactive exhibits.

New methods of analysing visitors' recollections of exhibits have been evolved, and these will enable sensible and quantitative discussion of, for example, the effectiveness of individual exhibits and of ISTCs themselves.

It would be interesting to explore in more detail the impact which Launch Pad, or any other ISTC, has on children. A research study could be devised which might consist of three main groups of children: one group would not visit Launch Pad, the second group would visit Launch Pad and be given follow-up exercises in recalling and talking about their experiences, whilst the third group would just visit Launch Pad and not be given any follow-up exercises. Over a period of twelve months the impact of a visit to Launch Pad and subsequent follow-up activities could be assessed.

On a practical level, the results of this study suggest that ISTCs should provide materials which visitors can use *after* their visits. It would appear that not only is a book (or information about the exhibits) essential, but that lists of things-to-do are highly desirable. These do not all have to be practically based; some could be games involving remembering or talking about the exhibits. A colleague of mine (Aubrey Tulley) once showed, for example, with a group of six primary school children who had visited Launch Pad a week previously that they could collectively remember all the exhibits and where they were positioned. As in the FUIs this stimulated a lot of reminding and talk about the exhibits.

The results also confirm the intuitive feelings of any good teacher (and accepted good practice) that in order to take full educational advantage of a visit to a museum such a trip should be planned with the children, discussed fully with them afterwards, related to their work in school and be a basis for subsequent practical and written work. The practice of writing thank-you letters has been shown to be a good one as it involves recalling the visit, thinking about it and thus increasing its memorability. How best to facilitate the process of learning after a museum visit is obviously an area of further study.

9.8 Closing Remarks

This study has shown that a visit to an ISTC is enjoyable, inspiring and thought-provoking. Above all, a visit generates a rich and varied set of personal experiences which remain highly memorable. By recalling these memories, visitors embark on a process of learning and understanding.

It follows that ISTCs (and probably museums) should place emphasis on providing these vivid memories rather than attempting to explain everything to the visitor whilst they are there since the process of learning will continue long after the visitor has left. However, it would appear that visitors need help in this continuing process.

Therefore it is true to say that the interactive science exhibits in Launch Pad do have an enjoyable and worthwhile impact on visitors, and that it is an impact which is felt for a long time afterwards.

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Appendix A is a list of exhibits as described in a handout to teachers written by Launch Pad staff.

Exhibits

Air Engine	A simple engine powered from an air blower. If you get the timing of the air supply right, it will drive the flywheel continuously.
Air Jet	Balance the beach ball on a vertical jet of air. Feel the Bernoulli force that keeps it in the jet even when it is tilted to one side.
Arch Bridge	Build an arch from the large hollow blocks. Remove the supports and test the arch by walking over it.
Balancing Blocks	A set of blocks weighted so that the centre of gravity is in an unexpected position. Can you build a 'sculpture' from them?
Ball-Cock & Syphon	Watch the transparent toilet cistern in action, and then explore how it works in a large-scale version.
Beamed Voices	Send a message to your friend at the other end of the gallery by bouncing the sound-waves between two large parabolic reflectors.
Bearing Kit	Make a large thrust bearing from the kit of parts. Sit on it to feel how well it turns.
Big Optics	Look at your friends and at Launch Pad through the giant-size optical components - lens, prism, and Fresnel lens.
Bubble Sheet	Can you make a flat soap film about 1 metre square? Watch the colours as it drains and try blowing against it.
Car Drag Test	Test the drag on cars of various shapes in the 'wind tunnel'. What shape of car is aerodynamically best?
Colour Box	Inside the box you can change the lighting and see the effect on yourself and your clothes. Make some coloured shadows too.
Computer Video	Watch yourself on the TV screen and see how the computer can change the picture. There's a range of special effects you can try.
Crane	Work the crane yourself to lift and move things. For our youngest visitors.

Divers	Squeeze a tube of water to sink the divers. Or try to keep them motionless. Can you see what makes them rise and fall?
Electric Dust	Rub the plastic lid of a large flat box to give it an electric charge. Watch the small chips of insulating material jump up and down inside.
Electric Generator	See how an electric current is produced when magnets and coils move closer together. And feel how hard it is to turn the handle when a large current is being produced.
Electric Motor	Put together an electric motor from the kit of parts. How fast can you get it to spin?
Energy Store	Cooperate with other visitors to pump water up into the storage tank. Then see it pour down and drive the Pelton wheel to produce electricity.
Flashwords	Glance quickly from one side of the gallery to the other and a line of lights turns into a ghostly word. How is it done?
Flight Test	Test the forces of lift and drag on the model aeroplane in the 'wind tunnel'. Which wing works best?
Flow Tank	A generous supply of flowing water. Block its path with a dam, or re-route it using sluices.
Gear Wheels	Gear wheels with varying numbers of teeth can be arranged in many different ways on a magnetic surface. Turn the handles to see the different rates at which they turn.
Giant Steelyard	Weigh your friend on the steelyard, by moving a counterweight along the beam until it is balanced.
Grain Pit	Use hand-operated conveyor belt, bucket chain, augurs and other equipment to move real grain around the exhibit.
Gyro Wheel	Spin the gyro wheel and feel what happens when you try to tilt it.
Hangover Problem	How far can you make the pile of blocks lean out over the edge of the platform?
Heat Pictures	See yourself in the dark with the infrared sensitive TV camera. Use it to find what's warm and what's cold.

Heavy Pen	Try to write or draw quickly with the special pen. It's hard to control the pen because it has a lot of mass attached.
Hot Hands	Warm the temperature-sensitive sheets with your hand, or by rubbing them. See how the 'liquid crystals' change colour.
Hot Or Cold	Feel the different surfaces. Some feel warm, some cool - but check the thermometers. It's all to do with conduction.
Human Battery	Connect two metal plates to the meter. Put a hand on each plate and you become the electrolyte of a simple cell. The meter registers the tiny current through you.
Inverting Pendulum	Start the pendulum swinging, then move the handle carefully to make the swings build up - resonance. Turn the handle fast and you may even make the rigid pendulum swing upside-down.
Kaleidoscope	Step inside this large triangle of mirrors and see how one person becomes a crowd. Watch from outside through the half-silvered window.
Leaning Tower	Try to build a tower from wooden blocks which are only approximately cubes.
Light Pipes	A tangle of twisted perspex pipes. Shine light in at one end and see where it comes out. The light source uses optical fibres.
Lock & Key	A large scale lock and key. fit the parts together and watch how it works when you turn the key.
Look Here	Explore the possibilities of prisms and other optical items by looking through these giant monocles.
Magnetic Pull	Feel the force produced by a tubular coil when an electric current goes through it. Check which materials respond to magnetism.
Musical Rockets	Run the models down the track and they play a tune. Move the bars to change the tune. For our youngest visitors.
Pedal Power	Pedal the bike and watch your power make the lamps light up. Feel how hard you have to work to generate electricity.
Pedal Power 2 & 3	Smaller versions of the PEDAL POWER exhibit, for people with shorter legs.
Plasma Ball	Streamers of coloured gases wave about inside the glass ball. Put

	your hand on the ball to attract the streamers and make new patterns of light. Hold the fluorescent tube nearby and it glows.
Pulleys & Belts	Link the pulleys with belts in various arrangements. Turn the handle to make it all move and measure the output speed on the speedometer.
Pulse Detector	When you touch the detector it picks up the electrical signals in your body which trigger your heart muscles. Check your pulse rate. Does it vary after you use one of the PEDAL POWER exhibits?
Puzzle Place 1 & 2	An assortment of puzzles involving the assembly of two and three dimensional shapes and topological problems.
River Bridge	How wide a bridge can you build from the seven blocks? The boat must fit under it.
Robot 1 and 2	Try to control the robots to do a simple task. Watch them do the same thing automatically.
Salt Bowl	A large dish of salt. Watch and feel what happens when a current of air is blown through it from below. Does it feel like a fluid? Can you float things on it?
Shake Hands	A large hemisphere of black perspex faces you. Put your hand at the centre where the spotlights shine on it. Can you shake hands with the real image of yourself?
Slow Bubbles	Use the pump to blow large bubbles at the bottom of the long tube of viscous silicone oil. Watch them as they rise and see how large ones swallow small ones.
Sounds Flat	The large flat plates are made from different materials. You can hit them with the hammers. What does the sound tell you about each material?
Stress Patterns	Use the large spanner and other items made from transparent plastic. Put on the special goggles to see the stress patterns in polarised light.
String Structure	Just a set of rods and strings which can hook together in various ways. Can you make a 'stool' from them, strong enough to hold your weight?
Teach The Turtle	A turtle-shaped robot moves around the pen controlled from a

	computer by a infrared link. Program a simple set of instructions into the computer to make the turtle do what you want.
Tipper Trucks	Fill each of the toy trucks with beans. As it runs down the slope another one comes up. For our youngest visitors.
Tiptoe Tester	Try to reach the detector without making the red lights flash. Be careful because it picks up vibrations from your footsteps, transmitted through the floor.
Train Wheels	Roll pairs of train wheels down a length of track. Some are coned inwards, some outwards, some not at all. Which ones follow the curved track best?
Turntable	A small platform which rotates freely. Stand on it and push yourself round like a human flywheel. Lean out, lean in, experience the effects of momentum conservation.
TV & Magnet	The TV screen shows your picture. Move the large magnet near it. Watch the colours change and the picture distort as you deflect the electrons inside the TV tube.
TV Aerial	Put together a TV aerial to pick up a picture from the relay station across the gallery. What arrangement gets the best picture?
Two-Way Mirror	Sit one side of the window while your friend sits the other. Vary the lighting on each side and see yourself change into friend, and vice versa.
Visible Air	Look at the warm air currents from your hands and face, and other warm things. See how the air flows round obstacles. It's the Schlieren Effect, all done by mirrors.
Watchdog	Watchdog emits growls and other sounds when you move in front of it. It's an ultrasonic burglar alarm on the Doppler principle, made audible.
Water Pump	Assemble a transparent hand pump from the parts provided. If you do it right you can use it to pump up some water. Watch the valve operate as it pumps.
Water Sculpture	Catch the falling jets of water. Re-direct them and use them in various ways to make your own 'water sculpture'.

Demonstrations

Electrostatics in Action
shows that electric charge does not just make your hair stand on end or give you shocks, but can also clean dirty smoke and spray paint round corners.

Liquid Gases The air that we breathe can be turned into very cold liquids which are used in industrial processes. The demonstration shows liquid nitrogen in action.

Making Paper shows how, using natural materials and kitchen equipment, you can experiment and produce your own personalised stationery.

IMAGES REDACTED DUE TO THIRD PARTY RIGHTS OR OTHER LEGAL ISSUES

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LAUNCH PAD POST-VISIT QUESTIONNAIRE

Date:_____ Time:_____ Interviewer:___

QUESTION	ADULT M/F	ADULT M/F	CHILD M/F	CHILD M/F	CHILD M/F
Have you enjoyed your visit to LP?					
How long have you spent in LP?					
Have you visited LP before? No?					
Compared to what museums normally offer, how do you rate LP?					
Which exhibit impressed you most?					
What about it impressed you?					
What other things did it remind you of?					
Do you think you learned anything from this exhibit?					
Do you feel that LP is really only for those who are particularly interested in science and technology, or is it for everybody?					

Would you be prepared to fill in a questionnaire in about two weeks time?	If selected, would you agree to a follow-up interview in several months time?	Ages?
		PVQ1A

LAUNCH PAD FOLLOW-UP QUESTIONNAIRE				
1. Have you visited Launch Pad since the day of your interview? If so, how many times?				
2. What kind of impression did the visit have on you? a) a great impression b) some impression c) little impression				
3. Did you talk about the visit with a) each other?				
b) other family or friends?				
4. Have you recommended Launch Pad to others?				
5. Which exhibit do you remember best?				
6. What about it do you remember?				

7. What did you have to do?				
8. What happened?				
9. What do you think the exhibit was all about?				
10. What other part of your day out do you remember well?				
11. Do you read a) New Scientist?				
b) Scientific American?				
12. Do you watch a) Tomorrow's World?				
b) Horizon?				
13. Your comments (on anything you like!)				

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FOLLOW-UP INTERVIEW

	A.	PREAMBLE
	A1	First of all, thank you for allowing me to come and talk to you and for volunteering to answer my questions.
	A2.	Secondly, let me explain what this is all about. This is part of a research project conducted by the Science Museum and the University of London under the supervision of Professor Jon Ogborn. We are collecting information about our displays in order that we might make them better. So this is not a test of you, more a test of the Museum.
	A3.	Thirdly, what is going to happen? Well, all I'm going to do is just ask a few questions and we'll see what happens! All personal details will be kept confidential, though I should like to publish the general findings of my research.
	A4.	Do you mind if I tape this interview (it saves me writing furiously!) - is that OK?
	A5.	Is there anything you want to ask me before we start?
	A6.	Today is the ..... I am talking to Group..... Who live in .....

	B.	**PRACTICAL INFORMATION**	
		I would like to get a few practical details sorted out first, about the day you visited Launch Pad and when I talked to you.	
	B1.	Can you tell me what day of the week you visited Launch Pad?	Sun Mon Tue Wed Thu Fri Sat
	B2	Can you tell me the exact date?	
	B3	Are you the same group who visited that day? [get details]	Name Relationship 1 2 3 4 5
	B4	What time did you leave home?	
	B5	What time did you arrive in the Museum?	
	B6	Did you go straight into Launch Pad? If no, how much later?	
	B7	How long did you spend in Launch Pad?	
	B8	Have you visited Launch Pad since then? If so, when?	
	B9	Have you visited anywhere similar. Before or since?	

FUT/2C

	C.	SPONTANEOUS RECALL
		For the following questions I would like each of you to give me your own answer.
	C1	Think about this for a moment before answering. Which part of your whole day out do you remember best?
		Now I would like to concentrate on the LP part of your visit for a while.
	C2	a) Now which exhibit do you remember best? b) Tell me about it.
	C3	a) Now pick another one. b) Tell me about it. Imagine you are telling a friend all about it.
	D	**PROMPTED RECALL** Now look at these photographs of exhibits in Launch Pad. Tell me whether you remember seeing them or not. If you do remember the exhibit did you have a go on it?

	E	FURTHER EXHIBIT RECOLLECTIONS
	E5	a) Tell me about an exhibit you would tell your friend to avoid. b) Why?
	E6	Tell me about an exhibit which you feel you understand.
	E7	Tell me about an exhibit which you feel you did not understand.
	E8	Pick any other one and tell me whether you understood it or not.
	E9	Can you say whether any of the exhibits were not working? Which ones were not?
	E10	Did you notice any of the Launch Pad staff? If so, what were they doing?

	F.	FEELINGS
	F1.	Here are some phrases. Which ones do you think describe LP well? Choose as many as you like.
	F2.	What do you think you got out of your visit?
	F3.	How do you feel about L.P.?
	F4.	Have your feelings changed since the day of your visit?
	F5.	Did your visit prompt you to follow it up in any way? If so, how?
	F6.	As a day out, how do you rate L.P.?
	F7.	How much do you think it would be worth spending on travelling in order to visit L.P.?

	G	**MISCELLANEOUS**
		Right, just a few miscellaneous questions to finish with:
	G1.	How did you travel to the Science Museum?
	G2.	What else did you do that day?
	G3.	Tell me what the weather was like the day you came?
	G4.	Tell me what you were wearing. How did you remember that?
	G5.	Can you remember anything else that happened on the same week as your L.P. visit? (How did you remember that?)
	H.	**CONCLUSION**
	H1	Is there anything you would like to go back over?
	H2	Is there anything you would like to ask me?
	H3	What do you think of this interview?!
	H4	Do you think I asked the right questions?
	G5	Which questions should I have asked?
		Thank you very, very much for being so helpful!

Which of the following phrases do you feel are the most accurate descriptions of Launch Pad?

Please tick.

1. **you can see how things work**
2. **can do it yourself**
3. **takes you by surprise**
4. **never a dull moment**
5. **must try until you've solved it**
6. **very entertaining place**
7. **lots to do with others**
8. **it looks attractive**
9. **sets you thinking**
10. **makes you want to have a go**
11. **it's all great fun**
12. **catches your imagination**
13. **difficult to tear yourself away**
14. **makes a big impression**
15. **it's quite a challenge**

REFLECTIONS ON A LAUNCH PAD VISIT

I should be most grateful if you would help me in my research into the impact of Launch Pad by giving me your opinions about what visitors to Launch Pad might say about their visit a few months later.

I have been talking to family groups who visited Launch Pad about 3 - 6 months ago. This follow-up interview lasts about an hour, and during that time I get the group to talk about their day out, particularly about their experiences in Launch Pad. The basic approach is one of free recall where each member of the group is encouraged to talk about things they remember best.

The purpose of the questionnaire is to find out what we would ***expect*** the results to look like. Therefore I should be most grateful if you would look at the following statements about what visitors may say about Launch Pad when recalling their visit. Please indicate with a tick whether you agree strongly, agree slightly, disagree slightly or disagree strongly with them. There is also a column to tick if you have not the faintest idea what to expect!

		Agree strongly	Agree slightly	Disagree slightly	Disagree strongly	No idea
1.	Visitors talk a lot about how much they enjoyed themselves.					
2.	They can recall a large number of exhibits.					
3.	They can remember the names of the exhibits.					
4.	They talk a lot about what the gallery looks like.					
5.	They talk a lot about what the exhibits look like.					
6.	They talk a lot about what they did with the exhibits.					
7.	They talk a lot about what other people did with the exhibits.					
8.	They talk a lot about how they felt at the time.					
9.	They talk a lot about what they read.					
10.	They talk a lot about what the exhibits are all about.					
11.	Visitors often provide scientific explanations for the effects exhibits are trying to show.					
12.	They talk mostly about exhibits they enjoyed.					
13.	They talk mostly about exhibits they understood.					

14.	They talk mostly about exhibits they found easy to do.					
15.	They talk mostly about exhibits they found puzzling.					
16.	Visitors do not talk about exhibits they did not enjoy.					
17.	Visitors do not talk about exhibits they found difficult.					
18.	There are "popular" exhibits which many visitors choose to talk about.					
19.	Visitors think it is a great day out.					
20.	Visitors say it is very "educational".					
21.	Visitors frequently say they want to know more about the exhibits.					
22.	Visitors cannot recall the exhibits which were not working.					
23.	Popular exhibits have easily identifiable characteristics.					
24.	There is a marked difference between the reactions of males and females.					
25.	There are many differences between the reactions of children and adults.					

If you think I have missed out an important question(s), please write it below:

If you have recently brought a school group to Launch Pad, or are planning to do so in the near future, and you would be willing to take part in my research then please write your name and address below:

Very many thanks for your help - John Stevenson, Education Officer

Throughout this thesis the following abbreviation and codes are used:

AM = Adult Male
AF = Adult Female
CM = Child Male
CF = Child Female
nM = n year old Male
nF = n year old Female

PVI = Post-Visit Interview
FUQ = Follow-Up Questionnaire
FUI = Follow-Up Interview

PVIn = the nth group given a Post-Visit Interview

N.B. Each group retains its same number throughout i.e. PVI72 and FUI72 refer to the same group but to the Post-Visit Interview and Follow-Up Interview respectively.

e.g. 12F/PVI36 = 12 year old girl in group 36 from the Post-Visit Interview.

In the transcripts, the following codes are used:

( ) = parts of the transcript which are too indistinct to be transcribed accurately.

(text) = uncertain parts of the transcript.

(9) = a pause 9 seconds long.

i.e. numbers in brackets indicate a pause of that number of seconds.

(.) = a short pause of less than one second.

[text] = comments on the interview itself, usually a description of the actions of the interviewees.

***Table J-i** Details of the tracked groups.*

TRACK	PVI	MEMBERS OF GROUP						NOTES
1	27	AF mother	11F dau	8F dau	AM granddad	AF grandma		
2	28	AM father	AF mother	6M son	4F dau			
3	29	AF mother	7M son					
4	30	AM father	AF mother	12F dau	12F friend			
5	31	AM father	AF mother	14M son	11M son	7M son	(4M) (son)	
6	32	AM father	AF mother	12M son	9M son			
7	-	AM father	AF mother	? son	? son			track abandoned
8	34	AM father	AF mother	13F dau	11M son			
9	35	AM father	AF mother	7F dau	5M son			
10	-	AM father	AF mother	~13F dau	~11F dau			would not agree to interview
11	42	AF mother	13F dau	10F dau				
12	46	AM father	AF mother	12M son	10M son			
13	49	AM father	AF mother	10F dau				
14	50	AM father	AF mother	8M son				
15	55	AM father	8M son	6F dau				
16	65	AM father	AF mother	8F dau	6M son			left UK at end of July
17	70	AF mother	14M son	8F dau	14M French friend			
18	74	AF mother	9M son	10M friend				
19	88	AM father	13F dau	11F dau				
20	93	AM father	AF mother	6F dau	4F dau			

Table J-ii Exhibit Daily Status Table

Ex No	Exhibit Name	Date of Post Visit Interview (see code below)																					
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
1	Turntable	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
2	Air Jet	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
4	Shake Hands	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
6	Bubble Sheet	N	N	P	P	P	P	P	N	N	N	P	P	P	P	P	P	P	P	P	N	N	P	P
7	Arch Bridge	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
8	Gear Wheels	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
9	Human Battery	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
10	Roller Run	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
11	Pump Kit	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
12	Electric Dust	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
13	TV & Magnet	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
15	Plasma Ball	N	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
17	Puzzle Corner	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
19	Teach The Turtle	P	P	P	P	P	P	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
21	Tip-Toe Tester	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
23	Watchdog	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
24	Kaleidoscope	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
25	Slow Bubbles	P	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	N	N
26	Light Pipes	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
27	Magnetic Pull	A	A	A	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
28	Cartesian Diver	N	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
30	Pulleys & Belts	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
31	Giant Steelyard	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
32	Train Wheels	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
33	Two-Way Mirror	P	P	P	P	P	P	P	P	P	P	A	A	A	A	A	A	A	P	P	P	P	N	N
37	Inverting Pendulum	A	A	A	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
38	Salt Bowl	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
39	Balancing Blocks	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
40	Leaning Tower	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Table J-ii Exhibit Daily Status Table

Ex No	Exhibit Name	Date of Post Visit Interview (see code below)																				
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
41	Grain Pit	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
44	Pedal Power 1	P	P	P	P	P	P	P	P	P	P	P	P	N	P	P	P	P	P	P	P	P	P	P
45	Energy Store	N	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
48	Magnetic River	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
49	Electric Motor	N	N	P	P	P	P	P	P	P	P	N	P	P	P	P	P	P	P	P	P	P	P	P
55	Flight Test	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
58	Look Here	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
59	Colour Box	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
60	Car Drag Test	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
64	Motorbike Suspension	A	A	A	N	N	N	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
66	Beamed Voices	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
67	TV Aerial	P	P	P	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
68	Flash Words	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
69	Touch Screen	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
71	Computer Video	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
72	Ballcock & Siphon	N	N	N	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
73	Lock & Key	P	P	P	P	P	P	P	P	P	P	P	P	P	N	P	P	P	P	P	P	P	N	N
75	Water Sculpture	N	N	N	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
82	Hot Hands	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
83	String Structure	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
84	Stress Patterns	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
85	Bearing Kit	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
86	Gyro Wheel	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
88	Robot 1	P	P	P	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
89	Heavy Pen	N	N	P	P	P	P	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P
90	Pedal Power Two	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
91	Pedal Power Three	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
92	Electric Generator	N	N	N	P	P	P	P	P	P	P	A	A	A	A	A	A	A	P	P	P	P	P	P
94	Pulse Detector	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	A	A	A	A	A	A

Table J-ii Exhibit Daily Status Table

Ex No	Exhibit Name	Date of Post Visit Interview (see code below)																				
		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w
96	Sounds Flat	P	P	P	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
98	Density Tester	N	N	N	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
99	Hot or Cold	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
100	Robot 2	N	N	P	P	P	P	P	P	P	P	N	N	P	P	P	P	P	P	P	P	P	P	P
106	Hangover Problem	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
107	Crane	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
108	Musical Trains	P	P	P	P	P	P	P	P	N	N	P	P	P	P	P	P	P	A	A	A	A	A	A
109	Flow Tank	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
111	River Bridge	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
112	Heat Pictures	P	P	P	P	P	P	P	N	N	N	P	P	P	P	P	P	P	P	P	P	P	P	P
113	Big Optics	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
115	Air Engine	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
118	Visible Air	P	P	P	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
119	Tipper Trucks	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
122	Colour Filter	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
127	Finger Paint	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
130	Harmonic Drive	A	A	A	A	A	A	A	A	A	A	P	P	P	P	P	P	P	P	P	P	P	P	P
136	Paper Making Demo	A	A	A	A	A	A	P	P	P	P	A	A	A	A	A	A	A	A	A	A	A	A	A
137	Rocket Demo	A	A	A	A	A	A	A	A	A	A	P	A	A	P	A	A	A	A	A	A	A	A	A
138	Bubble Demo	A	A	A	A	A	A	A	A	A	A	P	P	A	A	P	P	A	A	A	A	A	P	A
140	Laser Circles	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P

Dates a = 9/9/86 b = 10/9/86 c = 6/10/86 d = 1/5/87 e = 13/8/87 f = 17/8/87
g = 31/3/88 h = 5/4/88 i = 6/4/88 j = 7/4/88 k = 28/5/88 l = 30/5/88
m = 31/5/88 n = 1/6/88 o = 2/6/88 p = 3/6/88 q = 4/6/88 r = 11/6/88
s = 12/6/88 t = 18/6/88 u = 19/6/88 v = 25/6/88 w = 26/6/88

Code P = Present A = Absent N = Not working

Table J-iii Details of the groups completing a Follow-Up Questionnaire.

Group No	Members of Group					Group No	Members of Group				
18	AM	AF	6M			65	AM	AF	8F	6M	
19	AF	7M	5F			66	AM	AF	10M	9M	
20	AF	10F	6F			67	AM	13F	9F		
22	AM	AF	8F	7M		68	AM	AF	10F	7M	
24	AF	9F	7F			69	AF	10F	8M		
28	AM	AF	6M	4F		70	AF	14M	8F		
29	AF	7M				72	AM	AF	7M	3M	
30	AM	AF	12F	12F		73	AM	AF	8M	10F	
32	AM	AF	12M	9M		74	AF	10M	9M		
35	AM	AF	7F	5M		75	AM	AF	10F	8M	
36	AM	AF	12F	10F	5M	76	AM	AF	8M	8F	2x6M
38	AF	13F	5M			79	AF				
39	AM	11F	9M			81	AF				
40	AM	AF	13M	9M	7F	83	AF				
41	AM	AF	13F	12F		89	AM	AF	9M	6M	
42	AF	13F	10F			90	AM	AF	12F	5F	
43	AM	AF	8M			91	AM	AF	12F	10F	6M
44	AM	AF	11F	9M		92	AM	AF	14M	10F	
45	AM	AF	14F	12F	6F	93	AM	AF	6F	4F	
46	AM	AF	12M	10M		94	AM	AF	6M	3M	
47	AM	AF	17M	12M		96	AF	10F	10F		
51	AM	12M	9M			97	AM	AF	12F		
55	AM	8M	6F			98	AM	AF	13M		
56	AM	10F	4M			101	AM	AF	13F	10M	8M
57	AM	14F	9F			103	AM	AF	7F	6M	
59	AF	9F	7M			104	AF				
61	AM	AF	11M	9M		105	AM	AF	8M	6M	
62	AF	8M	7M			107	AF	12F	9F	9F	
63	AM	AF	10M	8M		108	AM	AF	13M	10M	
64	AM	AF	9F	6M							

Table J-iv Details of the groups given a Follow-Up Interview.

Group No	Members of Group				
19	AF	8M	6F		
20	AF	11F	6F		
27	AF	12F	8F		
28	AM	AF	6M		
29	AF	8M			
30	AM	AF	13F	13F	
31	AM	AF	14M	12M	8M
35	AM	AF	8F	5M	
36	AM	AF	13F	10F	6M
40	AM	AF	13M	9M	8F
42	AF	13F	11F		
43	AM	AF	9M		
44	AM	AF	10M		
55	9M	7M			
57	AM	15F	10F		
70	AF	15M	9F		
72	AM	AF	8M		
74	AF	10M	9M		
83	AF				
92	AM	14M	11F		
97	AM	AF	12F		
101	AM	AF	14F	11M	9M
103	AM	AF	8F	6M	
107	AF	12F	10F		

Table J-v Responses of a group of teachers to the Expectations questionnaire.

Statement	Agree Strongly	Agree Slightly	No Idea	Disagree Slightly	Disagree Strongly	Agree - ment	Rank
1	23	3	0	0	0	.94	1
2	23	2	1	0	0	.92	2
3	3	16	2	5	0	.33	14
4	2	2	4	14	4	-.31	23.5
5	3	10	1	7	5	-.02	21
6	21	4	0	1	0	.87	5
7	4	8	5	7	2	.10	17.5
8	4	13	1	5	0	.37	11
9	1	3	2	10	7	-.31	23.5
10	6	8	3	7	2	.17	15.5
11	3	5	0	6	4	.10	17.5
12	22	14	1	0	0	.90	3
13	11	7	0	3	4	.36	12
14	7	3	0	13	1	.08	19
15	5	6	1	6	0	.35	13
16	6	6	2	6	5	.06	20
17	1	9	1	14	7	-.44	25
18	17	13	1	1	1	.71	7
19	20	4	0	0	0	.88	4
20	17	7	0	0	0	.83	6
21	11	6	1	0	1	.63	8
22	14	8	2	4	2	.46	9.5
23	5		6	8	0	.17	15.5
24	2		3	6	9	-.27	22
25	12		1	2	3	.46	9.5

Table J-vi Responses of a group of professionals to the Expectations questionnaire.

Statement	Agree Strongly	Agree Slightly	No Idea	Disagree Slightly	Disagree Strongly	Agree - ment	Rank
1	6	2	0	0	0	.88	3.5
2	7	1	0	0	0	.94	1.5
3	3	3	0	2	0	.44	10
4	1	2	0	4	1	-.06	19
5	2	5	0	1	0	.50	9
6	3	4	0	1	0	.56	8
7	0	5	0	1	2	.00	18
8	2	4	0	2	0	.34	11
9	0	0	0	1	7	-.94	25
10	2	1	0	3	2	-.13	20
11	0	2	0	6	0	-.25	23
12	7	1	0	0	0	.94	1.5
13	1	5	0	1	1	.25	13.5
14	0	3	0	4	1	-.19	21.5
15	0	5	0	2	1	.06	17
16	1	2	0	3	2	-.19	21.5
17	0	2	0	3	3	-.44	24
18	6	2	0	0	0	.88	3.5
19	6	1	1	0	0	.81	5
20	5	2	0	1	0	.69	6
21	1	5	0	2	0	.31	12
22	2	2	0	4	0	.13	16
23	4	1	0	1	2	.25	13.5
24	0	3	0	4	1	.19	15
25	4	3	0	1	0	.63	7

Table K-i Summary data of the behaviour of the tracked subjects.

Age	6M	6.5M	7M	8F	8F	8M	8M	10F	10M	12F	13F	14M	14M	AF	AF	AF	AF	AM	AM	AM	mean	std dev	median
Track	2	20	3	1	16	14	15	13	18	4	19	5	17	7	8	10	11	6	9	12			
	(all figures below are in seconds - see section 4.2 for an explanation of the codes)																						
A	0	0	0	0	0	0	0	0	0	0	0	0	11	0	134	0	320	0	0	0	23	76	0
L	67	0	0	0	33	43	0	79	85	98	0	215	189	80	20	0	33	0	18	29	49	62	31
WC	0	224	0	211	0	0	0	18	0	0	0	0	13	111	0	0	0	0	0	76	33	70	0
Absent	67	224	0	211	33	43	0	97	85	98	0	215	213	191	154	0	353	0	18	105	105	101	91
M	489	455	346	728	810	498	510	514	488	566	452	537	911	1108	804	566	565	665	818	904	637	197	566
MH	0	0	0	0	0	0	0	0	0	0	0	0	0	293	0	0	0	0	0	0	15	66	0
MI	0	0	0	76	0	0	0	36	0	0	0	0	3	0	176	0	0	0	1	0	15	42	0
Moving	489	455	346	804	810	498	510	550	488	566	452	537	914	1401	980	566	565	665	819	904	666	250	566
O	781	548	761	1111	779	1049	1109	961	501	1665	928	1822	855	689	1442	1040	871	910	1447	684	998	355	919
OO	0	0	0	7	0	10	26	0	0	0	0	11	0	10	48	76	0	16	0	0	10	20	0
OD	0	0	449	4	0	0	0	0	0	133	0	13	7	0	0	0	0	0	27	0	32	103	0
OR	0	0	0	5	0	0	60	23	13	0	0	2	6	16	4	0	35	27	16	0	10	16	3
OB	0	0	0	0	42	0	11	29	14	0	0	9	0	0	0	0	35	0	0	0	7	13	0
OH	0	0	0	188	0	40	0	0	0	0	0	762	0	1289	0	0	0	0	634	459	169	350	0
Observing	781	548	1210	1315	821	1099	1206	1013	528	1798	928	2619	868	2004	1494	1116	941	953	2124	1143	1225	539	1108
I	275	324	200	267	1082	403	640	442	907	40	576	252	625	449	163	0	18	139	52	9	343	302	271
IG	244	958	218	1164	1246	779	1375	1128	1834	568	984	0	546	744	658	563	362	509	643	180	735	458	651
IV	326	149	862	535	199	97	69	1107	1033	45	139	989	404	18	89	0	0	0	0	0	303	386	118
IGV	0	590	0	4	210	324	415	149	420	471	41	0	48	0	19	83	171	12	542	56	178	205	70
ID	178	0	289	568	0	0	0	0	0	76	0	0	0	0	0	0	0	57	0	0	58	141	0
IH	0	0	85	0	0	48	0	0	14	0	0	0	0	0	25	0	0	0	112	0	14	32	0
Interacting	1023	2021	1654	2538	2737	1651	2499	2826	4208	1200	1740	1241	1623	1211	954	646	551	717	1349	245	1632	956	1486
Total Time	2360	3248	3210	4868	4401	3291	4215	4486	5309	3662	3120	4612	3618	4807	3582	2328	2410	2335	4310	2397	3628	960	3600

Table K-ii Numbers of exhibits which tracked subjects observed and interacted with.

Age	6M	6.5M	7M	8F	8F	8M	8M	10F	10M	12F	13F	14M	14M	AF	AF	AF	AF	AM	AM	AM	mean	std dev	median
Track	2	20	3	1	16	14	15	13	18	4	19	5	17	7	8	10	11	6	9	12			
Numbers of exhibits:																							
observed	33	16	16	32	23	23	25	35	16	34	26	26	32	18	28	33	26	28	34	18	26	7	26
interacted with	26	23	16	35	42	26	23	32	28	31	26	23	49	23	21	13	14	19	22	8	25	10	23
observed or interacted with or both	41	24	22	40	48	30	32	47	31	43	36	33	57	28	32	33	29	31	37	22	35	9	33
both observed and interacted with	18	15	10	27	17	19	16	20	13	22	19	16	24	13	17	13	11	16	19	4	16	5	17
only interacted with	8	8	6	8	25	7	7	12	15	9	7	7	25	10	4	0	3	3	3	4	9	7	7
only observed	15	1	6	5	6	4	9	15	3	12	7	10	8	5	11	20	15	12	15	14	10	5	10
neither observed nor interacted with	22	39	41	23	15	34	31	17	32	20	27	30	6	37	32	30	34	34	27	42	29	9	31
present in Launch Pad	63	63	63	63	63	64	63	64	63	63	63	63	63	65	64	63	63	65	64	64	63	1	63

Table K-iii Times for which the tracked subjects observed the exhibits.

	Age	6M	6F	7M	8F	8F	8M	8M	10F	10M	12F	13F	14M	14M	AF	AF	AF	AF	AM	AM	AM	mean	std dev	median	times ex present	no trying ex	Popularity %
	Track	2	20	3	1	16	14	15	13	18	4	19	5	17	7	8	10	11	6	9	12						
Ex No	Exhibit Name	(all numbers below are in seconds)																									
1	Turntable	58	81	5	226	219	147	97	21		272	99	5	14	89	211		45	24		164	105	87	89	20	17	85
2	Air Jet	25	38			39	11	30			40	26		5		115	25	50	5	147		43	42	30	20	13	65
4	Shake Hands	26	5		44				37		5					19	28	6		39		23	15	26	20	9	45
6	Bubble Sheet						52		37		35			13		32	64				51	41	17	37	14	7	50
7	Arch Bridge			8	10						11		58		186	48				38		51	63	38	20	7	35
8	Gear Wheels	5			7			1			5			5	16				9	16		8	5	6	20	8	40
9	Human Battery	15			5			26	25				20			9						17	9	18	20	6	30
10	Roller Run							12	17		11		7			18				21	33	17	9	17	20	7	35
11	Pump Kit													47								47		47	20	1	5
12	Electric Dust	40			2	5			5	8		12		14		7		40	16			15	14	10	20	10	50
13	TV & Magnet			8	15				5		6			6	15		32			41		16	13	12	20	8	40
15	Plasma Ball	9			9				11	6	53	13					36	28	13	24	21	20	14	13	20	11	55
17	Puzzle Corner	8					16		45		66			9		86		9	140	11		43	46	16	20	9	45
21	TipToe Tester	30		43	171	40	22	63	22	131	181	16		88	59	20		59	36	70	170	72	57	59	20	17	85
23	Watchdog				16			14		5	9					12	33	13		7	22	15	9	13	20	9	45
24	Kaleidoscope	29			8					22	48	42	60	35			8				10	29	19	29	20	9	45
25	Slow Bubbles			15	40	28	76	23	34		221	45	138	11	20		9	64	9	43		52	58	34	18	15	83
26	Light Pipes	5			137			14	37	11	10	43	17				21	32	16	31	44	32	34	21	20	13	65
28	Cartesian Diver	18			15	9			56		9					24	11					20	17	15	20	7	35
30	Pulleys & Belts	31		5								5	5		9				12			11	10	7	20	6	30
31	Giant Steelyard						8		123		194	9		36				36				68	75	36	20	6	30
32	Train Wheels	23			13			67			4	12	55			98			37	88	5	40	35	30	20	10	50
33	TwoWay Mirror	114					-	-	-		18			47	-	-	-	-	-	-	-	60	49	47	9	3	33
38	Salt Bowl		8		13	20			14	18		6	5	14	17		106	45				24	29	14	20	11	55
39	Balancing Blocks								14								29			5		16	12	14	20	3	15
40	Leaning Tower		11		8				10													10	2	10	20	3	15
41	Grain Pit	12	35	9	104	62		8	16	16	59	46	8	25	28	18	12		157	138	13	43	46	22	20	18	90
44	Pedal Power 1	34	46			13		1						7	17				20	8		18	15	15	18	8	44
45	Energy Store					7			10			15		13	12			21	59	26	43	23	17	15	20	9	45
48	Magnetic River	35				14			25			10	7	18			37			13		20	11	16	20	8	40
49	Electric Motor								56					17	-		87			7		42	37	37	18	4	22
55	Flight Test	27	133		80		39	17		12			37				8					44	42	32	20	8	40
58	Look Here										5		5			7	16		12	37		14	12	10	20	6	30
59	Colour Box																3					3		3	20	1	5
60	Car Drag Test	44				9	13			5			5	11	10					11	43	17	15	11	20	9	45
66	Beamed Voices	59		50	83		64		7		124	12	27	35	23	17	29		70	11		44	33	32	20	14	70
68	Flash Words							71		27			5	6		104	43	46				43	36	43	20	7	35
69	Touch Screen			55																		55		55	20	1	5
71	Computer Video	6		128		55	7		13		7	100	30	13	94			11	33	7		39	42	13	20	13	65
73	Lock & Key				9				98		7			7		84	16					37	42	13	18	6	33
82	Hot Hands				16		5	5	31						17	24	72			14		23	22	17	20	8	40
83	String Structure						10		39				5				34				14	20	15	14	20	5	25
84	Stress Patterns	23			6						18	15	11	49			52	9	27	35	15	24	16	18	20	11	55
85	Bearing Kit	10	14		9			17								11	53					19	17	13	20	6	30
86	Gyro Wheel		44		33				9		6		10				61			47		30	22	33	20	7	35
89	Heavy Pen	-		-	-	102	7	5			-	21	-	6		27						28	37	14	15	6	40
90	Pedal Power 2		34	33	17	14	5	19					5		58		42		31	44		27	17	31	20	11	55
91	Pedal Power 3	22	31		33	12	41	33	11		24	12	16					94	12	103		34	30	24	20	13	65
92	Electric Generator						-	-	-		46	12			-	-	-	-	-	-	-	29	24	29	10	2	20

Table K-iii Times for which the tracked subjects observed the exhibits.

	Age	6M	6F	7M	8F	8F	8M	8M	10F	10M	12F	13F	14M	14M	AF	AF	AF	AF	AM	AM	AM	mean	std dev	median	times ex present	no trying ex	Popularity %
	Track	2	20	3	1	16	14	15	13	18	4	19	5	17	7	8	10	11	6	9	12						
Ex No	Exhibit Name	(all numbers below are in seconds)																									
94	Pulse Detector		-			-	103			-	139	-		-		249		139	25			131	81	139	15	5	33
99	Hot or Cold					8			10	5					16	10	12	20		8	6	11	5	10	20	9	45
100	Robot 2	5		465	36	18	370	604	10	65		5	1273	131				38				252	382	52	16	12	75
106	Hangover Problem				10			5			42					68						31	29	26	20	4	20
107	Crane		23	262		7	30	15		50	87							33				63	84	32	20	8	40
108	Musical Trains	5	-		11	-		41		-		-		-			21		21	66		28	22	21	12	6	50
109	Flow Tank	10	30				11			128	11	30		119				19	6	179	21	51	61	21	20	11	55
111	River Bridge		5			52		12								117	44					46	44	44	20	5	25
112	Heat Pictures		10													41				90		47	40	41	16	3	19
113	Big Optics			19				6	2			12		22			4	15	8	36		14	11	12	20	9	45
115	Air Engine			5		9										8	39					15	16	9	20	4	20
119	Tipper Trucks	16		97		5	17		26	6				28		10			100			34	37	17	20	9	45
122	Colour Filter						5		10		9		5						17			9	5	9	20	5	25
127	Finger Paint	14			22							305		8				26				75	129	22	20	5	25
130	Harmonic Drive	-		-	-				16		-	5	-		29			27	10			17	10	16	15	5	33
136	Papermaking Demo		-		188	-	-	-	-	-		-	762	-	-	-	-	-	-	-	-	475	406	475	5	2	40
137	Rocket Demo	-	-	-	-	-	-	-	-	-	-	-	-	-	644	-	-	-	-	-	459	552	131	552	3	2	67
138	Bubble Demo	-		-	-	-	40	-		-	-	-	-	-	645		-	-		634	-	440	346	634	7	3	43
140	Laser Circles	10			26	26			82		13		23	9			29	15		29		26	21	25	20	10	50
150																											
	Subject observe time	768	548	1207	1422	773	1099	1206	984	515	1795	928	2604	868	2004	1494	1116	940	925	2124	1134						
	Exhibits observed	31	16	16	33	23	23	25	35	16	34	26	27	32	20	28	33	26	27	35	17						
	Mean ex obs time	25	34	75	43	34	48	48	28	32	53	36	96	27	100	53	34	36	34	61	67						
	Mean =	46.76			Standard Deviation =			96.85		No of observations =			523														
	Median =	20.00			Range		1	to	1273																		

Table K-iv Times which the tracked subjects interacted with the exhibits.

	Age	6M	6F	7M	8F	8F	8M	8M	10F	10M	12F	13F	14M	14M	AF	AF	AF	AF	AM	AM	AM	mean	std dev	median	times ex	no trying	Popularity
	Track	2	20	3	1	16	14	15	13	18	4	19	5	17	7	8	10	11	6	9	12				present	ex	%
Ex No	Exhibit Name	(all numbers below are in seconds)																									
1	Turntable		73		26	34	26	56				32		1								35	23	32	20	7	35
2	Air Jet	13				98	93	202			135	211		5		16				20		88	81	93	20	9	45
4	Shake Hands	15	73		22	33	16	53	40	13	91	49		22	45	76		36		46		42	24	40	20	15	75
6	Bubble Sheet						53		66					35		127					7	58	45	53	14	5	36
7	Arch Bridge	23		62					64	144	21		65	9	44							54	42	53	20	8	40
8	Gear Wheels		139	47	67	72		117	51		1	38		13	22	10				76	27	52	41	47	20	13	65
9	Human Battery	18			75		28	63	80	9			10	38								40	29	33	20	8	40
10	Roller Run		63						12		59	84		16	70	14		45	17			42	28	45	20	9	45
11	Pump Kit	39																				39		39	20	1	5
12	Electric Dust	17			34	45			37			24		2	23							26	14	24	20	7	35
13	TV & Magnet		17	10		39						35	24		16							24	11	21	20	6	30
15	Plasma Ball	40			53	29				94	47	32		44		17		31	20	112		47	30	40	20	11	55
17	Puzzle Corner					347	1		304	17	19	74		56	180	65		81	110	29		107	113	70	20	12	60
21	TipToe Tester	23		48	40	90	21	59		87	14			15	12	35			32	11		37	27	32	20	13	65
23	Watchdog				30		17	20			13		18	10		21	42			46	15	23	12	19	20	10	50
24	Kaleidoscope	77		10	65	44		49	37	40	23	33	25	12	19		13			25	24	33	19	25	20	15	75
25	Slow Bubbles						47				62	107		53	57				15			57	30	55	18	6	33
26	Light Pipes	29			163	82				39	8	79	9	35	18			29		14	15	43	45	29	20	12	60
28	Cartesian Diver				73	48			90					42								63	22	61	20	4	20
30	Pulleys & Belts								57				202		99							119	75	99	20	3	15
31	Giant Steelyard						74	67	96	72		134						22				78	37	73	20	6	30
32	Train Wheels	25		72	46		89	330	79	33	50	1	50	11						18		67	87	48	20	12	60
33	TwoWay Mirror	71	10			85	-	-	-		55				-	-	-	-	-	-	-	55	33	63	9	4	44
38	Salt Bowl	32	178	137	109	75		30	56	24		67	29	91			20					71	50	62	20	12	60
39	Balancing Blocks				53	35			95		49			21			26					47	27	42	20	6	30
40	Leaning Tower		18		60	102			119		8				6	9						46	48	18	20	7	35
41	Grain Pit	87	44	75	98	79			301	741				136								195	234	93	20	8	40
44	Pedal Power 1	14	14			25	7	86					11	44	22				22			27	25	22	18	9	50
45	Energy Store	38	105		274		288		76	119			34	108	52				60			115	92	91	20	10	50
48	Magnetic River					43					31		38							65		44	15	41	20	4	20
49	Electric Motor				79			279			29			1	-					116		101	109	79	18	5	28
55	Flight Test		70		219	24	50	82		127			22	46								80	66	60	20	8	40
58	Look Here				32	91				19	66		35	40		17	83	44	12	146	66	54	39	42	20	12	60
59	Colour Box	96			77	24			99	69	29	28	64	80	26		46	94		274	17	73	65	67	20	14	70
60	Car Drag Test	13				32	22	52		36		41		8	15							27	15	27	20	8	40
66	Beamed Voices	38		86	89	19	42			41	48	22	27	18	29	21	24		16	56	74	41	24	34	20	16	80
68	Flash Words					104				88	70			24		30	115					72	38	79	20	6	30
69	Touch Screen													12								12		12	20	1	5
71	Computer Video			163		50	61					40	86	69						35		72	44	61	20	7	35
73	Lock & Key				322											47						185	194	185	18	2	11
82	Hot Hands				14	40	6	59			49		9	39	10		31			50		31	20	35	20	10	50
83	String Structure													148								148		148	20	1	5
84	Stress Patterns		13		102	66			21		5	78	20	14				53	37			41	33	29	20	10	50
85	Bearing Kit		48			57		3	18	14				16					9			24	21	16	20	7	35
86	Gyro Wheel		17		42	19		75	13	137		31	57	14								45	41	31	20	9	45
89	Heavy Pen	-		-	-	78	53			62	-	80	-			36						62	18	62	15	5	33
90	Pedal Power 2		21	59	52	19	36	87				84										51	28	52	20	7	35
91	Pedal Power 3	38	106		20	99	25	30	28	78		1		9					13			41	37	28	20	11	55
92	Electric Generator					76	-	-	-		31	15		26	-	-	-	-	-	-	-	37	27	29	10	4	40

Table K-iv Times which the tracked subjects interacted with the exhibits.

	Age	6M	6F	7M	8F	8F	8M	8M	10F	10M	12F	13F	14M	14M	AF	AF	AF	AF	AM	AM	AM	mean	std dev	median	times ex present	no trying ex	Popularity %
	Track	2	20	3	1	16	14	15	13	18	4	19	5	17	7	8	10	11	6	9	12						
Ex No	Exhibit Name	(all numbers below are in seconds)																									
94	Pulse Detector		-			-	78			-	22	-		-		96			61			64	32	70	15	4	27
99	Hot or Cold	29	80	19	19				28	16	5			30	66	14	26	10	22			28	22	22	20	13	65
100	Robot 2			309			453	441		494			350	5								342	179	396	16	6	38
106	Hangover Problem				68				86		65					163						96	46	77	20	4	20
107	Crane		149	231			13	231		419								55				183	146	190	20	6	30
108	Musical Trains		-		29	-		28	85	-		-		-					8	7		31	32	28	12	5	42
109	Flow Tank	10	203		12	66			249	1170		91		32						80		213	368	80	20	9	45
111	River Bridge		89							5				35		58	94					56	37	58	20	5	25
112	Heat Pictures		116			130			69			29		10	63	58				16		61	44	61	16	8	50
113	Big Optics					48			15		29			25		24	41	15		30		28	12	27	20	8	40
115	Air Engine	34				30	18						19									25	8	25	20	4	20
119	Tipper Trucks	138	375	294		22			292										13			189	153	215	20	6	30
122	Colour Filter	30		32		30	34		21		24			9	102				35			35	26	30	20	9	45
127	Finger Paint				27							177		46								83	82	46	20	3	15
130	Harmonic Drive	-		-	-	42					-	23	-	14	208			18	119	77		72	71	42	15	7	47
136	Papermaking Demo		-			-	-	-	-	-		-		-	-	-	-	-	-	-	-				5	0	0
137	Rocket Demo	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-						3	0	0
138	Bubble Demo	-		-	-	-		-		-	-	-	-	-			-	-			-				7	0	0
140	Laser Circles	30			35	159			142		41		32	34			85	18				64	53	35	20	9	45
150																											
	Subject interact time	1017	2021	1654	2526	2730	1651	2499	2826	4207	1199	1740	1236	1623	1204	954	646	551	621	1349	245						
	Exs interacted with	26	23	16	34	42	26	23	32	28	31	29	23	49	23	21	13	14	18	22	8						
	Mean ex int time	39	88	103	74	65	64	109	88	150	39	60	54	33	52	45	50	39	35	61	31						
	Mean =	64.87			Standard Deviation =			90.39		No of interactions =			501														
	Median =	40.00			Range	1	to	1170																			

***Table L-i** Responses to the PVI question: "Have you enjoyed your visit?".*

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	74	*98.7*	96	*97.0*	106	*99.1*	97	*99.0*	373	*98.4*
Ambivalent	1	*1.3*	3	*3.0*	0	*0*	1	*1.0*	5	*1.3*
No	0	*0.0*	0	*0.0*	1	*0.9*	0	*0.0*	1	*0.3*
Totals	75	*100.0*	99	*100.0*	107	*100.0*	98	*100.0*	379	*100.0*

Table L-ii *Comparison of reported lengths of time spent in Launch Pad with those obtained from the tracking data.*

Group		Reported Time (mins)	Actual Time (mins)	Percentage Error
Tracked No	PVI No			
1	27	75	81	-7
3	29	60	54	11
4	30	60	61	-2
5	31	70	77	-9
6	32	35	39	-10
8	34	70	60	17
9	35	90	72	25
11	42	60	40	50
12	46	45	40	13
13	49	75	75	0
14	50	60	55	9
15	55	60	70	-14
16	65	90	73	23
17	70	90	60	50
18	74	105	88	19
19	88	70	52	35
20	93	45	54	-17

Table L-iii Responses to the PVI question: "Have you visited Launch Pad before?".

No of previous visits	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
0	66	*86*	77	*74*	82	*72*	72	*71*	297	*75*
1	8	*10*	15	*14*	17	*15*	16	*16*	56	*14*
2	3	*4*	7	*7*	7	*6*	8	*8*	25	*6*
≥ 3	0	*0*	5	*5*	8	*7*	5	*5*	18	*5*
Totals	77	*100*	104	*100*	114	*100*	101	*100*	396	*100*

Table L-iv Responses to the PVI question: "Compared to what museums normally offer, how do you rate Launch Pad?".

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Much better	67	*88*	88	*86*	90	*90*	84	*89*	329	*88*
Slightly better	6	*8*	10	*10*	9	*9*	9	*10*	34	*9*
Slightly worse	3	*4*	4	*4*	1	*1*	1	*1*	9	*3*
Much worse	0	*0*	0	*0*	0	*0*	0	*0*	0	*0*
Totals	76	*100*	102	*100*	100	*100*	94	*100*	372	*100*

Figure L-v Impressiveness for each exhibit

		Counts and Opportunities of Most Impressed Exhibits										IMPRESSIVENESS				
EXHIBIT	EX NO	AM no	AM opp	AF no	AF opp	CM no	CM opp	CF no	CF opp	TOTAL no	TOTAL opp	AM	AF	CM	CF	TOTAL
Turntable	1	0	74	1	102	7	113	13	99	21	388	0.00	0.98	6.19	13.13	5.41
Air Jet	2	2	74	1	102	4	113	3	99	10	388	2.70	0.98	3.54	3.03	2.58
Shake Hands	4	3	74	9	102	1	113	5	99	18	388	4.05	8.82	0.88	5.05	4.64
Bubble Sheet	6	0	53	3	69	0	80	1	77	4	279	0.00	4.35	0.00	1.30	1.43
Arch Bridge	7	2	74	1	102	2	113	1	99	6	388	2.70	0.98	1.77	1.01	1.55
Gear Wheels	8	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
Human Battery	9	1	74	1	102	0	113	0	99	2	388	1.35	0.98	0.00	0.00	0.52
Roller Run	10	1	61	0	86	0	94	0	87	1	328	1.64	0.00	0.00	0.00	0.30
Pump Kit	11	3	65	2	90	0	97	0	90	5	342	4.62	2.22	0.00	0.00	1.46
Electric Dust	12	0	74	0	102	0	113	3	99	3	388	0.00	0.00	0.00	3.03	0.77
TV & Magnet	13	0	74	0	102	1	113	0	99	1	388	0.00	0.00	0.88	0.00	0.26
Plasma Ball	15	6	63	6	88	6	96	7	89	25	336	9.52	6.82	6.25	7.87	7.44
Puzzle Corner	17	2	74	2	102	0	113	2	99	6	388	2.70	1.96	0.00	2.02	1.55
Teach the Turtle	19	0	17	2	23	0	27	0	22	2	89	0.00	8.70	0.00	0.00	2.25
TipToe Tester	21	1	74	2	102	4	113	5	99	12	388	1.35	1.96	3.54	5.05	3.09
Watchdog	23	1	74	2	102	0	113	1	99	4	388	1.35	1.96	0.00	1.01	1.03
Kaleidoscope	24	4	74	4	102	3	113	4	99	15	388	5.41	3.92	2.65	4.04	3.87
Slow Bubbles	25	1	57	4	77	3	84	0	77	8	295	1.75	5.19	3.57	0.00	2.71
Light Pipes	26	1	74	1	102	0	113	1	99	3	388	1.35	0.98	0.00	1.01	0.77
Magnetic Pull	27	0	6	0	9	0	10	0	12	0	37	0.00	0.00	0.00	0.00	0.00
Cartesian Diver	28	0	63	0	88	2	96	0	89	2	336	0.00	0.00	2.08	0.00	0.60
Pulleys & Belts	30	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
Giant Steelyard	31	1	74	0	102	0	113	0	99	1	388	1.35	0.00	0.00	0.00	0.26
Train Wheels	32	0	74	3	102	3	113	2	99	8	388	0.00	2.94	2.65	2.02	2.06
TwoWay Mirror	33	0	37	0	54	0	56	0	45	0	192	0.00	0.00	0.00	0.00	0.00
Inverting Pendulum	37	0	6	0	9	0	10	0	12	0	37	0.00	0.00	0.00	0.00	0.00
Salt Bowl	38	1	65	1	90	2	97	1	90	5	342	1.54	1.11	2.06	1.11	1.46
Balancing Blocks	39	1	74	0	102	0	113	0	99	1	388	1.35	0.00	0.00	0.00	0.26
Leaning Tower	40	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
Grain Pit	41	1	74	6	102	14	113	7	99	28	388	1.35	5.88	12.39	7.07	7.22
Pedal Power	44	1	73	4	100	8	113	7	95	20	381	1.37	4.00	7.08	7.37	5.25
Energy Store	45	2	63	4	88	0	96	2	89	8	336	3.17	4.55	0.00	2.25	2.38
Magnetic River	48	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
Electric Motor	49	1	63	0	88	0	95	0	89	1	335	1.59	0.00	0.00	0.00	0.30
Flight Test	55	2	65	2	90	2	97	0	90	6	342	3.08	2.22	2.06	0.00	1.75
Look Here	58	3	74	1	102	0	113	0	99	4	388	4.05	0.98	0.00	0.00	1.03
Colour Box	59	0	74	2	102	4	113	4	99	10	388	0.00	1.96	3.54	4.04	2.58
Car Drag Test	60	0	74	0	102	0	113	1	99	1	388	0.00	0.00	0.00	1.01	0.26
Beamed Voices	66	9	74	5	102	18	113	9	99	41	388	12.16	4.90	15.93	9.09	10.57
TV Aerial	67	0	17	0	23	0	27	0	22	0	89	0.00	0.00	0.00	0.00	0.00
Flash Words	68	1	74	2	102	0	113	0	99	3	388	1.35	1.96	0.00	0.00	0.77
Touch Screen	69	0	57	1	79	0	86	1	77	2	299	0.00	1.27	0.00	1.30	0.67
Computer Video	71	4	74	6	102	3	113	2	99	15	388	5.41	5.88	2.65	2.02	3.87
Lock & Key	73	0	58	1	78	1	86	0	77	2	299	0.00	1.28	1.16	0.00	0.67
Water Sculpture	75	1	6	0	9	0	10	1	12	2	37	16.67	0.00	0.00	8.33	5.41
Hot Hands	82	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
String Structure	83	2	74	0	102	0	113	1	99	3	388	2.70	0.00	0.00	1.01	0.77
Stress Patterns	84	1	74	0	102	0	113	0	99	1	388	1.35	0.00	0.00	0.00	0.26
Bearing Kit	85	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
Gyro Wheel	86	2	74	0	102	0	113	0	99	2	388	2.70	0.00	0.00	0.00	0.52
Robot 1	88	1	17	1	23	5	27	0	22	7	89	5.88	4.35	18.52	0.00	7.87
Heavy Pen	89	0	61	0	84	2	91	0	85	2	321	0.00	0.00	2.20	0.00	0.62
Electric Generator	92	1	37	0	59	0	59	0	52	1	207	2.70	0.00	0.00	0.00	0.48
Pulse Detector	94	0	30	1	35	0	44	0	41	1	150	0.00	2.86	0.00	0.00	0.67
Sounds Flat	96	0	17	0	23	0	27	0	22	0	89	0.00	0.00	0.00	0.00	0.00
Hot or Cold	99	1	74	0	102	0	113	0	99	1	388	1.35	0.00	0.00	0.00	0.26
Robot 2	100	2	57	0	82	8	87	1	79	11	305	3.51	0.00	9.20	1.27	3.61
Hangover Problem	106	1	74	7	102	0	113	0	99	8	388	1.35	6.86	0.00	0.00	2.06
Crane	107	0	74	2	102	2	113	2	99	6	388	0.00	1.96	1.77	2.02	1.55
Musical Trains	108	0	45	1	55	0	66	0	61	1	227	0.00	1.82	0.00	0.00	0.44
Flow Tank	109	0	63	3	88	3	96	2	89	8	336	0.00	3.41	3.13	2.25	2.38
River Bridge	111	1	74	1	102	1	113	0	99	3	388	1.35	0.98	0.88	0.00	0.77
Heat Pictures	112	5	71	1	98	0	107	1	96	7	372	7.04	1.02	0.00	1.04	1.88
Big Optics	113	0	74	0	102	0	113	1	99	1	388	0.00	0.00	0.00	1.01	0.26
Air Engine	115	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00
Visible Air	118	0	17	1	23	0	27	0	22	1	89	0.00	4.35	0.00	0.00	1.12
Tipper Trucks	119	0	74	0	102	2	113	1	99	3	388	0.00	0.00	1.77	1.01	0.77
Colour Filter	122	0	57	0	79	0	86	0	77	0	299	0.00	0.00	0.00	0.00	0.00
Finger Paint	127	0	61	2	86	0	94	5	87	7	328	0.00	2.33	0.00	5.75	2.13
Harmonic Drive	130	0	53	1	73	0	80	0	72	1	278	0.00	1.37	0.00	0.00	0.36
Papermaking Demo	136	0	4	0	6	0	6	0	5	0	21	0.00	0.00	0.00	0.00	0.00
Rocket Demo	137	0	7	0	7	0	9	0	5	0	28	0.00	0.00	0.00	0.00	0.00
Bubble Demo	138	1	19	0	26	1	29	1	28	3	102	5.26	0.00	3.45	3.57	2.94
Laser Circles	140	0	57	2	79	0	86	1	77	3	299	0.00	2.53	0.00	1.30	1.00
Information	150	0	74	0	102	1	113	0	99	1	388	0.00	0.00	0.88	0.00	0.26
none	No Ex	0	74	0	102	0	113	0	99	0	388	0.00	0.00	0.00	0.00	0.00

***Table L-vi** "Impressiveness" of those exhibits which impressed adult males in the PVIs.*

Ex No	Exhibit	Impressiveness	Ex No	Exhibit	Impressiveness
75	Water Sculpture	16.67	92	Electric Generator	2.70
66	Beamed Voices	12.16	25	Slow Bubbles	1.75
15	Plasma Ball	9.52	10	Roller Run	1.64
112	Heat Pictures	7.04	49	Electric Motor	1.59
88	Robot 1	5.88	38	Salt Bowl	1.54
24	Kaleidoscope	5.41	44	Pedal Power	1.37
71	Computer Video	5.41	9	Human Battery	1.35
138	Bubble Demo	5.26	21	TipToe Tester	1.35
11	Pump Kit	4.62	23	Watchdog	1.35
4	Shake Hands	4.05	26	Light Pipes	1.35
58	Look Here	4.05	31	Giant Steelyard	1.35
100	Robot 2	3.51	39	Balancing Blocks	1.35
45	Energy Store	3.17	41	Grain Pit	1.35
55	Flight Test	3.08	68	Flash Words	1.35
2	Air Jet	2.70	84	Stress Patterns	1.35
7	Arch Bridge	2.70	99	Hot or Cold	1.35
17	Puzzle Corner	2.70	106	Hangover Problem	1.35
83	String Structure	2.70	111	River Bridge	1.35
86	Gyro Wheel	2.70			

Table L-vii "Impressiveness" of those exhibits which impressed adult females in the PVIs.

Ex No	Exhibit	Impressiveness	Ex No	Exhibit	Impressiveness
4	Shake Hands	8.82	55	Flight Test	2.22
19	Teach the Turtle	8.70	17	Puzzle Corner	1.96
106	Hangover Problem	6.86	21	TipToe Tester	1.96
15	Plasma Ball	6.82	23	Watchdog	1.96
41	Grain Pit	5.88	59	Colour Box	1.96
71	Computer Video	5.88	68	Flash Words	1.96
25	Slow Bubbles	5.19	107	Crane	1.96
66	Beamed Voices	4.90	108	Musical Trains	1.82
45	Energy Store	4.55	130	Harmonic Drive	1.37
6	Bubble Sheet	4.35	73	Lock & Key	1.28
88	Robot 1	4.35	69	Touch Screen	1.27
118	Visible Air	4.35	38	Salt Bowl	1.11
44	Pedal Power	4.00	112	Heat Pictures	1.02
24	Kaleidoscope	3.92	1	Turntable	0.98
109	Flow Tank	3.41	2	Air Jet	0.98
32	Train Wheels	2.94	7	Arch Bridge	0.98
94	Pulse Detector	2.86	9	Human Battery	0.98
140	Laser Circles	2.53	26	Light Pipes	0.98
127	Finger Paint	2.33	58	Look Here	0.98
11	Pump Kit	2.22	111	River Bridge	0.98

***Table L-viii** "Impressiveness" of those exhibits which impressed child males in the PVIs.*

Ex No	Exhibit	Impressiveness	Ex No	Exhibit	Impressiveness
88	Robot 1	18.52	32	Train Wheels	2.65
66	Beamed Voices	15.93	71	Computer Video	2.65
41	Grain Pit	12.39	89	Heavy Pen	2.20
100	Robot 2	9.20	28	Cartesian Diver	2.08
44	Pedal Power	7.08	38	Salt Bowl	2.06
15	Plasma Ball	6.25	55	Flight Test	2.06
1	Turntable	6.19	7	Arch Bridge	1.77
25	Slow Bubbles	3.57	107	Crane	1.77
2	Air Jet	3.54	119	Tipper Trucks	1.77
21	TipToe Tester	3.54	73	Lock & Key	1.16
59	Colour Box	3.54	4	Shake Hands	0.88
138	Bubble Demo	3.45	13	TV & Magnet	0.88
109	Flow Tank	3.13	111	River Bridge	0.88
24	Kaleidoscope	2.65	150	Information	0.88

Table L-ix "Impressiveness" of those exhibits which impressed child females in the PVIs.

Ex No	Exhibit	Impressiveness	Ex No	Exhibit	Impressiveness
1	Turntable	13.13	32	Train Wheels	2.02
66	Beamed Voices	9.09	71	Computer Video	2.02
75	Water Sculpture	8.33	107	Crane	2.02
15	Plasma Ball	7.87	6	Bubble Sheet	1.30
44	Pedal Power	7.37	69	Touch Screen	1.30
41	Grain Pit	7.07	140	Laser Circles	1.30
127	Finger Paint	5.75	100	Robot 2	1.27
4	Shake Hands	5.05	38	Salt Bowl	1.11
21	TipToe Tester	5.05	112	Heat Pictures	1.04
24	Kaleidoscope	4.04	7	Arch Bridge	1.01
59	Colour Box	4.04	23	Watchdog	1.01
138	Bubble Demo	3.57	26	Light Pipes	1.01
2	Air Jet	3.03	60	Car Drag Test	1.01
12	Electric Dust	3.03	83	String Structure	1.01
45	Energy Store	2.25	113	Big Optics	1.01
109	Flow Tank	2.25	119	Tipper Trucks	1.01
17	Puzzle Corner	2.02			

Table L-x Analysis of responses to the PVI question: "What about it impressed you?".

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Descriptions	19	*28*	42	*46*	68	*66*	45	*52*	174	*50*
Feelings	26	*38*	35	*38*	21	*20*	31	*36*	113	*32*
Thoughts	24	*34*	15	*16*	14	*14*	10	*12*	63	*18*
Totals	69	*100*	92	*100*	103	*100*	86	*100*	350	*100*

Table L-xi Responses to the PVI question: "What other things did it remind you of?".

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Reminded	37	*66*	58	*69*	40	*48*	32	*41*	167	*55*
Not reminded	19	*34*	26	*31*	44	*52*	47	*59*	136	*45*
Totals	56	*100*	84	*100*	84	*100*	79	*100*	303	*100*

***Table L-xii** Responses to the PVI question: "Do you think you learned anything from this exhibit?".*

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	33	*47*	48	*52*	53	*55*	59	*66*	193	*55*
No	37	*53*	44	*48*	43	*45*	31	*34*	155	*45*
Totals	70	*100*	92	*100*	96	*100*	90	*100*	348	*100*

***Table L-xiii** Responses to the PVI question: "Do you feel that Launch Pad is particularly for those interested in science and technology, or is it for everybody?".*

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	0	*0*	3	*3*	8	*9*	1	*1*	12	*4*
No	70	*100*	89	*97*	81	*91*	81	*99*	321	*96*
Totals	70	*100*	92	*100*	89	*100*	82	*100*	333	*100*

Table M-i Responses to the FUQ question: "What kind of impression did the visit have on you?".

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Great	26	*62*	32	*60*	43	*72*	36	*68*	137	*65.9*
Some	16	*38*	21	*40*	17	*28*	16	*30*	70	*33.6*
Little	0	*0*	0	*0*	0	*0*	1	*2*	1	*0.5*
Totals	42	*100*	53	*100*	60	*100*	53	*100*	208	*100*

Table M-ii Responses to the FUQ question: "Did you talk about the visit with (a) each other, (b) other family or friends?".

Talked to:	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Each other	36	*86*	42	*79*	49	*82*	37	*70*	164	*79*
Other family/ friends	28	*67*	43	*81*	43	72	37	*70*	151	*73*
No-one	0	*0*	1	*2*	1	*2*	2	*4*	4	*2*
	n=42		n=53		n=60		n=53		n=208	

***Table M-iii** Responses to the FUQ question: "Have you recommended Launch Pad to others?".*

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	29	*69*	46	*87*	36	*60*	35	*66*	146	*70*
No	13	*31*	7	*13*	24	*40*	18	*34*	62	*30*
Totals	42	*100*	53	*100*	60	*100*	53	*100*	208	*100*

Table M-iv Responses to the FUQ question: "Which exhibit did you remember best?".

		Adult Males		Adult Females		Child Males		Child Females		TOTAL		REMEMBEREDNESS				
	EXHIBIT NAME	No	Opps	No	Opps	No	Opps	No	Opps	NO	OPPS	AM	AF	CM	CF	TOTAL
1	Turntable	0	42	3	53	4	60	6	53	13	208	0.00	5.66	6.67	11.32	6.25
2	Air Jet	2	42	1	53	4	60	3	53	10	208	4.76	1.89	6.67	5.66	4.81
4	Shake Hands	0	42	1	53	1	60	1	53	3	208	0.00	1.89	1.67	1.89	1.44
6	Bubble Sheet	0	34	1	40	0	48	1	43	2	165	0.00	2.50	0.00	2.33	1.21
7	Arch Bridge	1	42	2	53	2	60	1	53	6	208	2.38	3.77	3.33	1.89	2.88
8	Gear Wheels	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
9	Human Battery	0	42	1	53	0	60	0	53	1	208	0.00	1.89	0.00	0.00	0.48
10	Roller Run	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
11	Pump Kit	2	42	0	53	1	60	0	53	3	208	4.76	0.00	1.67	0.00	1.44
12	Electric Dust	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
13	TV & Magnet	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
15	Plasma Ball	1	42	2	53	1	60	8	53	12	208	2.38	3.77	1.67	15.09	5.77
17	Puzzle Corner	0	42	1	53	0	60	0	53	1	208	0.00	1.89	0.00	0.00	0.48
19	Teach the Turtle	0	2	1	5	0	3	0	6	1	16	0.00	20.00	0.00	0.00	6.25
21	TipToe Tester	1	42	0	53	1	60	2	53	4	208	2.38	0.00	1.67	3.77	1.92
23	Watchdog	0	42	0	53	1	60	0	53	1	208	0.00	0.00	1.67	0.00	0.48
24	Kaleidoscope	2	42	1	53	6	60	2	53	11	208	4.76	1.89	10.00	3.77	5.29
25	Slow Bubbles	0	34	3	42	0	50	2	43	5	169	0.00	7.14	0.00	4.65	2.96
26	Light Pipes	2	42	1	53	0	60	0	53	3	208	4.76	1.89	0.00	0.00	1.44
27	Magnetic Pull	0	2	0	5	0	3	0	6	0	16	0.00	0.00	0.00	0.00	0.00
28	Cartesian Diver	0	42	0	53	1	60	0	53	1	208	0.00	0.00	1.67	0.00	0.48
30	Pulleys & Belts	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
31	Giant Steelyard	1	42	0	53	0	60	0	53	1	208	2.38	0.00	0.00	0.00	0.48
32	Train Wheels	2	42	0	53	1	60	2	53	5	208	4.76	0.00	1.67	3.77	2.40
33	TwoWay Mirror	0	24	0	36	0	34	0	33	0	127	0.00	0.00	0.00	0.00	0.00
37	Inverting Pendulum	0	2	0	5	0	3	0	6	0	16	0.00	0.00	0.00	0.00	0.00
38	Salt Bowl	0	42	0	53	1	60	1	53	2	208	0.00	0.00	1.67	1.89	0.96
39	Balancing Blocks	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
40	Leaning Tower	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
41	Grain Pit	3	42	6	53	4	60	2	53	15	208	7.14	11.32	6.67	3.77	7.21
44	Pedal Power	1	42	2	53	5	60	3	53	11	208	2.38	3.77	8.33	5.66	5.29
45	Energy Store	2	42	3	53	1	60	1	53	7	208	4.76	5.66	1.67	1.89	3.37
48	Magnetic River	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
49	Electric Motor	0	41	0	52	0	58	0	53	0	204	0.00	0.00	0.00	0.00	0.00
55	Flight Test	2	42	2	53	1	60	0	53	5	208	4.76	3.77	1.67	0.00	2.40
58	Look Here	1	42	1	53	0	60	0	53	2	208	2.38	1.89	0.00	0.00	0.96
59	Colour Box	0	42	3	53	3	60	1	53	7	208	0.00	5.66	5.00	1.89	3.37
60	Car Drag Test	1	42	0	53	0	60	0	53	1	208	2.38	0.00	0.00	0.00	0.48
66	Beamed Voices	5	42	3	53	8	60	6	53	22	208	11.90	5.66	13.33	11.32	10.58
67	TV Aerial	0	2	0	5	0	3	0	6	0	16	0.00	0.00	0.00	0.00	0.00
68	Flash Words	1	42	0	53	1	60	0	53	2	208	2.38	0.00	1.67	0.00	0.96
69	Touch Screen	0	40	1	48	0	57	0	47	1	192	0.00	2.08	0.00	0.00	0.52
71	Computer Video	1	42	3	53	1	60	0	53	5	208	2.38	5.66	1.67	0.00	2.40
73	Lock & Key	0	29	0	37	0	44	0	39	0	149	0.00	0.00	0.00	0.00	0.00
75	Water Sculpture	1	2	0	5	0	3	1	6	2	16	50.00	0.00	0.00	16.67	12.50
82	Hot Hands	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
83	String Structure	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
84	Stress Patterns	1	42	0	53	0	60	0	53	1	208	2.38	0.00	0.00	0.00	0.48
85	Bearing Kit	0	42	0	53	1	60	0	53	1	208	0.00	0.00	1.67	0.00	0.48
86	Gyro Wheel	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
88	Robot 1	0	2	0	5	0	3	0	6	0	16	0.00	0.00	0.00	0.00	0.00
89	Heavy Pen	0	40	1	50	0	58	0	50	1	198	0.00	2.00	0.00	0.00	0.51
92	Electric Generator	1	24	0	36	0	34	0	33	1	127	4.17	0.00	0.00	0.00	0.79
94	Pulse Detector	0	20	0	20	0	28	0	23	0	91	0.00	0.00	0.00	0.00	0.00
96	Sounds Flat	0	2	0	5	0	3	0	6	0	16	0.00	0.00	0.00	0.00	0.00
99	Hot or Cold	1	42	0	53	0	60	0	53	1	208	2.38	0.00	0.00	0.00	0.48
100	Robot 2	0	37	1	48	3	52	0	47	4	184	0.00	2.08	5.77	0.00	2.17
106	Hangover Problem	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
107	Crane	0	42	0	53	1	60	0	53	1	208	0.00	0.00	1.67	0.00	0.48
108	Musical Trains	0	22	1	25	0	31	0	29	1	107	0.00	4.00	0.00	0.00	0.93
109	Flow Tank	0	42	1	53	0	60	3	53	4	208	0.00	1.89	0.00	5.66	1.92
111	River Bridge	1	42	1	53	1	60	0	53	3	208	2.38	1.89	1.67	0.00	1.44
112	Heat Pictures	3	42	3	53	1	60	0	53	7	208	7.14	5.66	1.67	0.00	3.37
113	Big Optics	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
115	Air Engine	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
118	Visible Air	0	2	0	5	0	3	0	6	0	16	0.00	0.00	0.00	0.00	0.00
119	Tipper Trucks	0	42	0	53	0	60	1	53	1	208	0.00	0.00	0.00	1.89	0.48
122	Colour Filter	0	40	0	48	0	57	0	47	0	192	0.00	0.00	0.00	0.00	0.00
127	Finger Paint	0	42	1	53	1	60	1	53	3	208	0.00	1.89	1.67	1.89	1.44
130	Harmonic Drive	0	38	0	45	0	55	2	44	2	182	0.00	0.00	0.00	4.55	1.10
136	Papermaking Demo	0	2	0	3	0	2	0	3	0	10	0.00	0.00	0.00	0.00	0.00
137	Rocket Demo	0	6	0	6	0	8	0	4	0	24	0.00	0.00	0.00	0.00	0.00
138	Bubble Demo	0	11	0	11	0	15	1	12	1	49	0.00	0.00	0.00	8.33	2.04
140	Laser Circles	1	40	3	48	1	57	2	47	7	192	2.50	6.25	1.75	4.26	3.65
150	Information	0	42	0	53	0	60	0	53	0	208	0.00	0.00	0.00	0.00	0.00
	none	2	42	2	53	0	60	0	53	4	208	4.76	3.77	0.00	0.00	1.92

Table M-v Responses to the FUQ question: "Have you visited Launch Pad since the day of your visit?".

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	0	*0*	1	*2*	2	*3*	2	*4*	5	*2*
No	42	*100*	52	*98*	58	*97*	51	*96*	203	*98*
Totals	42	*100*	53	*100*	60	*100*	53	*100*	208	*100*

Table M-vi Responses to the FUQ question: "Do you read New Scientist or Scientific American?".

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	7	*17*	4	*8*	1	*2*	0	*0*	12	*6*
Sometimes	2	*5*	4	*8*	0	*0*	1	*2*	7	*3*
No	32	*78*	44	*84*	57	*98*	50	*98*	183	*91*
Totals	41	*100*	52	*100*	58	*100*	51	*100*	202	*100*

Table M-vii *Responses to the FUQ question: "Do you watch Tomorrow's World or Horizon?".*

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	29	*71*	36	*69*	32	*55*	25	*49*	122	*60*
Sometimes	7	*17*	10	*19*	5	*9*	12	*24*	34	*17*
No	5	*12*	6	*12*	21	*36*	14	*27*	46	*23*
Totals	41	*100*	52	*100*	58	*100*	51	*100*	202	*100*

Table M-viii *Responses to the FUQ question: "Have you any formal science qualifications?".*

	Adult Males		Adult Females		Child Males		Child Females		Totals	
	n	%	n	%	n	%	n	%	n	%
Yes	17	*44*	15	*33*	2	*4*	2	*5*	36	*20*
No	22	*56*	30	*67*	53	*96*	42	*95*	147	*80*
Totals	39	*100*	45	*100*	55	*100*	44	*100*	183	*100*

***Table N-i** Positive responses to FUI question D: "Did you see this exhibit? If so, did you try it?"*

	Seen		Tried		Photographs
	n	%	n	%	n
Adult Males	137	77	90	50	179
Adult Females	206	76	128	47	270
Child Males	240	89	213	79	269
Child Females	235	80	198	67	295
Totals	818	81	629	62	1013

Table N-ii Analysis of the Follow-Up Interview subjects' exhibit memories into the main categories.

Group	Adult/ Child	Sex	Age	Not Remembered	Mention Only	Elaborated Clear	Elaborated Less Clear	Spontaneous Recall	Prompt Person	Prompt Photo	Descriptions	Feelings	Thoughts	Total Comments
19	A	F	A	8	7	8	0	4	2	17	7	1	2	10
19	C	M	8	4	9	7	3	5	1	17	10	1	2	13
19	C	F	6	5	12	5	0	5	0	17	6	0	0	6
20	A	F	A	9	5	7	0	5	1	15	7	6	7	20
20	C	F	6	7	7	4	1	4	1	14	4	0	2	6
20	C	F	11	5	5	13	0	5	3	15	11	4	9	24
27	A	F	A	7	5	9	1	2	5	15	9	1	4	14
27	C	F	8	3	8	10	0	4	2	15	9	1	1	11
27	C	F	12	3	4	17	0	6	4	14	18	2	8	28
28	A	M	A	6	7	4	0	2	0	15	4	1	3	8
28	A	F	A	6	2	10	1	5	2	12	8	1	10	19
28	C	M	6	2	7	8	0	3	2	12	7	3	2	12
29	A	F	A	7	2	7	2	4	1	13	11	4	6	21
29	C	M	8	3	7	8	0	5	2	11	5	3	3	11
30	A	M	A	6	7	8	0	6	1	14	8	3	3	14
30	C	F	13	5	7	8	0	6	1	13	7	4	4	15
30	A	F	A	5	6	5	2	2	1	15	6	2	3	11
30	C	F	13	4	9	7	0	6	1	13	7	3	1	11
31	A	M	A	3	8	8	0	6	0	13	4	3	7	14
31	A	F	A	1	8	9	0	6	1	11	11	6	6	23
31	C	M	8	1	14	6	0	8	0	13	4	1	4	9
31	C	M	12	2	11	9	0	9	0	13	10	1	2	13
31	C	M	14	2	10	10	0	10	0	12	10	3	6	19
35	A	M	A	4	6	11	0	5	5	11	10	7	8	25
35	A	F	A	4	6	9	0	6	4	9	8	5	8	21
35	C	M	5	4	11	3	0	2	2	14	3	1	0	4
35	C	F	8	6	4	6	0	3	1	12	5	0	2	7
36	A	M	A	4	9	18	2	11	10	12	19	5	7	31
36	A	F	A	4	9	19	0	11	8	13	20	3	5	28
36	C	M	6	1	16	25	1	10	18	15	24	4	7	35
36	C	F	10	2	7	14	1	7	3	14	13	2	6	21
36	C	F	13	4	11	14	0	5	9	15	12	1	3	16
40	A	M	A	1	10	6	0	4	1	12	7	3	5	15
40	A	F	A	3	9	8	0	4	2	14	8	2	4	14
40	C	M	9	5	8	6	0	5	0	14	6	2	0	8
40	C	M	13	2	10	10	0	6	2	14	11	1	2	14
40	C	F	8	7	5	6	0	4	1	13	5	0	2	7
42	A	F	A	4	3	8	4	4	4	11	15	5	8	28
42	C	F	11	3	2	13	1	7	2	10	18	2	5	25
42	C	F	13	3	5	13	2	4	7	12	16	4	9	29
43	A	M	A	4	9	4	0	4	0	13	3	3	4	10
43	A	F	A	2	10	10	0	6	2	14	9	4	4	17

Table N-ii Analysis of the Follow-Up Interview subjects' exhibit memories into the main categories.

Group	Adult/ Child	Sex	Age	Not Remembered	Mention Only	Elaborated Clear	Elaborated Less Clear	Spontaneous Recall	Prompt Person	Prompt Photo	Descriptions	Feelings	Thoughts	Total Comments
43	C	M	9	0	11	8	1	8	0	12	9	2	2	13
44	A	M	A	11	7	5	0	6	1	16	7	1	4	12
44	A	F	A	8	5	8	1	5	3	14	8	2	6	16
44	C	M	10	4	7	10	0	3	5	13	9	1	7	17
55	C	M	9	4	3	11	0	5	0	13	9	4	9	22
55	C	F	7	5	3	8	0	4	2	10	9	1	3	13
57	A	M	A	2	3	15	1	6	4	11	14	3	9	26
57	C	F	10	4	4	10	0	3	4	11	13	0	2	15
57	C	F	15	3	4	14	1	5	5	12	19	3	6	28
70	A	F	A	6	4	9	0	7	0	12	11	5	9	25
70	C	M	15	3	8	11	0	6	5	11	11	1	7	19
70	C	F	9	4	9	6	0	4	3	12	7	0	0	7
72	A	M	A	5	2	14	0	7	2	12	16	4	6	26
72	A	F	A	3	8	9	0	6	2	12	11	1	1	13
72	C	M	8	2	8	13	1	6	4	14	13	2	3	18
74	A	F	A	2	6	11	0	6	0	13	10	4	4	18
74	C	M	9	0	7	17	0	8	4	12	15	5	2	22
74	C	M	10	0	2	21	0	9	5	9	21	4	5	30
83	A	F	A	3	6	16	1	12	0	14	14	4	8	26
92	A	M	A	4	3	19	2	11	6	11	24	4	6	34
92	C	M	14	3	7	21	0	9	10	12	23	1	13	37
92	C	F	11	4	3	24	0	12	5	14	25	8	12	45
97	A	M	A	6	2	9	1	4	0	14	9	2	6	17
97	A	F	A	3	4	15	0	4	4	14	17	5	7	29
97	C	F	12	5	6	7	0	5	0	13	9	2	4	15
101	A	M	A	3	7	9	2	5	4	12	12	3	5	20
101	A	F	A	4	7	14	1	10	3	13	15	6	7	28
101	C	M	9	4	10	8	0	6	1	15	8	3	2	13
101	C	M	11	2	10	9	0	5	3	13	9	1	5	15
101	C	F	14	4	4	10	0	5	0	13	10	4	3	17
103	A	M	A	6	9	8	0	5	3	15	5	3	4	12
103	A	F	A	2	4	13	0	5	2	12	13	2	9	24
103	C	M	6	0	8	15	0	6	5	12	14	0	6	20
103	C	F	8	3	8	6	1	2	3	13	6	0	4	10
107	A	F	A	1	11	9	2	7	3	13	12	5	3	20
107	C	F	10	3	7	7	2	4	3	12	11	2	0	13
107	C	F	12	0	11	9	1	6	1	14	11	3	2	16
TOTALS				**297**	**545**	**818**	**39**	**453**	**217**	**1029**	**854**	**209**	**375**	**1438**
percentages				*17*	*32*	*48*	*2*	*27*	*13*	*61*	*59*	*15*	*26*	*100*
							Total Number of Exhibit Memories =			**1699**				

***Table N-iii** Effect of Type on Quality of recall of the exhibit memories.*

QUALITY	SPONTANEOUS RECALL		PROMPT: PHOTOGRAPH		PROMPT: PERSON		TOTALS	
	%	n	%	n	%	n	%	n
Not Remembered	0.0	(0)	16.9	(287)	0.6	(10)	17.5	(297)
Mention Only	1.4	(23)	27.4	(465)	3.4	(57)	32.1	(545)
Elab - Clear	24.1	(410)	15.4	(261)	8.7	(147)	48.1	(818)
Elab - Less Clear	1.1	(20)	0.9	(16)	0.2	(3)	2.3	(39)
Totals	26.7	(453)	60.6	(1029)	12.8	(217)	100.0	(1699)

***Table N-iv** Analysis of Type of recall on the main categories of exhibit memories.*

	ADULTS				CHILDREN			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
SPONTANEOUS RECALL								
Description	79	(46)	122	(46)	134	(58)	129	(60)
Feeling	35	(21)	64	(24)	30	(13)	35	(16)
Thought	57	(33)	80	(30)	66	(29)	52	(24)
	12.2		*12.7*		*11.0*		*9.4*	
PROMPT: PERSON								
Description	21	(58)	28	(65)	39	(68)	40	(66)
Feeling	6	(17)	2	(5)	4	(7)	5	(8)
Thought	9	(25)	13	(30)	14	(25)	16	(26)
	2.6		*2.0*		*2.7*		*2.7*	
PROMPT: PHOTOGRAPH								
Description	43	(74)	80	(71)	58	(75)	82	(76)
Feeling	4	(7)	7	(6)	10	(13)	6	(6)
Thought	11	(19)	26	(23)	9	(12)	20	(18)
	4.1		*5.4*		*3.7*		*4.7*	*4.5*

N.B. Figures in italics show the average number of exhibit memories recalled by a subject in each category.

Table N-v Analysis of the Follow-Up Interview subjects' descriptive exhibit memories.

				EXHIBIT					ACTIONS					Total	Total	GRAND
Group	Adult/ Child	Sex	Age	Accurate	Inaccurate	Not Working	Position	Busy	Self	With Others	Just Others	Failure	Helper	Exhibit Comments	Action Comments	TOTAL
19	A	F	A	0	0	0	0	0	0	4	2	0	1	0	7	7
19	C	M	8	2	2	0	0	2	4	0	0	0	0	6	4	10
19	C	F	6	1	0	0	0	0	4	0	1	0	0	1	5	6
20	A	F	A	0	0	2	0	0	3	2	0	0	0	2	5	7
20	C	F	6	0	1	0	0	0	1	2	0	0	0	1	3	4
20	C	F	11	1	0	0	1	0	9	0	0	0	0	2	9	11
27	A	F	A	0	0	0	1	0	3	1	4	0	0	1	8	9
27	C	F	8	1	0	0	0	1	4	1	2	0	0	2	7	9
27	C	F	12	2	0	1	1	0	7	4	2	0	1	4	14	18
28	A	M	A	0	0	2	0	0	1	1	0	0	0	2	2	4
28	A	F	A	1	0	2	0	0	1	3	1	0	0	3	5	8
28	C	M	6	1	0	1	0	0	4	1	0	0	0	2	5	7
29	A	F	A	0	0	0	1	1	3	0	5	0	1	2	9	11
29	C	M	8	0	0	0	0	1	3	0	0	1	0	1	4	5
30	A	M	A	1	0	0	2	0	3	0	2	0	0	3	5	8
30	C	F	13	0	0	0	0	0	6	0	1	0	0	0	7	7
30	A	F	A	0	0	0	1	0	1	0	4	0	0	1	5	6
30	C	F	13	0	0	0	0	0	5	1	1	0	0	0	7	7
31	A	M	A	0	0	0	0	0	2	0	2	0	0	0	4	4
31	A	F	A	0	0	0	1	0	3	2	3	2	0	1	10	11
31	C	M	8	2	0	0	0	0	1	0	0	0	1	2	2	4
31	C	M	12	0	0	0	0	0	5	1	2	0	2	0	10	10
31	C	M	14	1	0	1	1	1	5	0	0	0	1	4	6	10
35	A	M	A	1	0	1	1	1	1	1	4	0	0	4	6	10
35	A	F	A	0	0	0	0	0	2	4	2	0	0	0	8	8
35	C	M	5	0	0	1	0	0	2	0	0	0	0	1	2	3
35	C	F	8	0	0	0	0	0	2	2	1	0	0	0	5	5
36	A	M	A	1	0	2	1	0	9	1	4	0	1	4	15	19
36	A	F	A	2	0	2	0	0	2	4	6	2	2	4	16	20
36	C	M	6	2	0	3	0	0	16	1	1	1	0	5	19	24
36	C	F	10	1	0	0	0	0	6	3	0	1	2	1	12	13
36	C	F	13	2	0	1	0	0	4	0	3	1	1	3	9	12
40	A	M	A	0	0	1	0	0	3	0	2	1	0	1	6	7
40	A	F	A	1	0	1	0	0	1	1	4	0	0	2	6	8
40	C	M	9	1	0	1	1	0	3	0	0	0	0	3	3	6
40	C	M	13	1	0	1	0	0	5	0	3	1	0	2	9	11
40	C	F	8	0	0	0	0	0	5	0	0	0	0	0	5	5
42	A	F	A	3	2	1	1	0	4	2	2	0	0	7	8	15
42	C	F	11	4	1	0	0	0	9	2	1	1	0	5	13	18
42	C	F	13	2	0	0	1	2	8	2	1	0	0	5	11	16
43	A	M	A	1	0	0	0	0	2	0	0	0	0	1	2	3
43	A	F	A	0	0	3	0	0	5	0	1	0	0	3	6	9
43	C	M	9	0	0	2	0	0	6	0	0	1	0	2	7	9

Table N-v Analysis of the Follow-Up Interview subjects' descriptive exhibit memories.

				EXHIBIT					ACTIONS					Total	Total	GRAND
Group	Adult/ Child	Sex	Age	Accurate	Inaccurate	Not Working	Position	Busy	Self	With Others	Just Others	Failure	Helper	Exhibit Comments	Action Comments	TOTAL
44	A	M	A	4	0	1	0	1	1	0	0	0	0	6	1	7
44	A	F	A	0	0	1	0	0	5	0	1	1	0	1	7	8
44	C	M	10	3	0	0	0	0	5	0	1	0	0	3	6	9
55	C	M	9	1	0	0	0	0	6	2	0	0	0	1	8	9
55	C	F	7	0	0	0	0	0	8	0	1	0	0	0	9	9
57	A	M	A	3	0	2	1	0	2	1	5	0	0	6	8	14
57	C	F	10	1	0	1	3	0	8	0	0	0	0	5	8	13
57	C	F	15	2	0	2	2	0	9	2	2	0	0	6	13	19
70	A	F	A	1	0	0	2	0	1	3	3	1	0	3	8	11
70	C	M	15	2	0	1	1	0	6	0	0	0	1	4	7	11
70	C	F	9	0	0	1	1	0	3	2	0	0	0	2	5	7
72	A	M	A	1	0	0	1	0	5	4	2	1	2	2	14	16
72	A	F	A	0	0	1	0	0	3	3	1	1	2	1	10	11
72	C	M	8	1	0	0	0	0	10	2	0	0	0	1	12	13
74	A	F	A	1	0	1	0	1	1	1	4	0	1	3	7	10
74	C	M	9	1	0	1	0	0	9	3	1	0	0	2	13	15
74	C	M	10	7	0	1	0	0	8	2	1	0	2	8	13	21
83	A	F	A	1	0	1	0	0	6	2	3	0	1	2	12	14
92	A	M	A	2	1	6	2	0	6	3	2	1	1	11	13	24
92	C	M	14	1	2	2	2	0	12	4	0	0	0	7	16	23
92	C	F	11	1	0	1	0	1	14	4	3	1	0	3	22	25
97	A	M	A	2	0	1	2	0	2	0	2	0	0	5	4	9
97	A	F	A	2	0	1	4	0	3	3	4	0	0	7	10	17
97	C	F	12	1	0	0	0	0	6	0	2	0	0	1	8	9
101	A	M	A	1	1	0	1	0	2	1	6	0	0	3	9	12
101	A	F	A	1	0	1	0	0	5	4	4	0	0	2	13	15
101	C	M	9	1	0	0	0	0	7	0	0	0	0	1	7	8
101	C	M	11	1	0	2	0	0	5	1	0	0	0	3	6	9
101	C	F	14	3	0	1	0	0	2	3	1	0	0	4	6	10
103	A	M	A	0	0	0	1	0	0	2	2	0	0	1	4	5
103	A	F	A	0	0	1	0	0	1	5	5	0	1	1	12	13
103	C	M	6	2	0	0	0	0	12	0	0	0	0	2	12	14
103	C	F	8	0	0	0	0	0	4	1	0	1	0	0	6	6
107	A	F	A	1	0	4	0	0	5	0	2	0	0	5	7	12
107	C	F	10	1	0	1	1	0	7	1	0	0	0	3	8	11
107	C	F	12	1	0	3	0	2	4	0	1	0	0	6	5	11
TOTALS				85	10	67	38	14	366	105	126	19	24	214	640	854
percentages				*10*	*1*	*8*	*4*	*2*	*43*	*12*	*59*	*9*	*11*	*25*	*75*	*100*
							Total Number of Descriptions =		854							

Table N-vi Analysis of the Follow-Up Interview subjects' feelings exhibit memories.

				Pleasure				Wonder			Displeasure			Difficulty		Misgiving		Total	Total	Grand
Group	Adult/ Child	Sex	Age	Enjoyment	Satisfaction	Amusement	Affection	Clarity	Fascination	Surprise	Challenge	Annoyance	Dis-satisfaction	Dislike	Difficult	Boring	Worry	Avoid	Positive	Negative	Total
19	A	F	A	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1
19	C	M	8	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1
19	C	F	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	A	F	A	2	0	0	0	0	2	0	0	0	1	0	1	0	0	0	4	2	6
20	C	F	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	4
20	C	F	11	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	3	1	4
27	A	F	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
27	C	F	8	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
27	C	F	12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	2
28	A	M	A	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1
28	A	F	A	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	1	0	1
28	C	M	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
29	A	F	A	1	0	0	0	0	2	0	0	0	0	1	0	0	0	0	3	0	3
29	C	M	8	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	2	3
30	A	M	A	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	2	1	3
30	C	F	13	1	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0	4
30	A	F	A	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	2
30	C	F	13	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2	1	3
31	A	M	A	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2	1	3
31	A	F	A	0	0	2	1	0	1	0	0	0	1	1	0	1	0	0	4	2	6
31	C	M	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
31	C	M	12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1
31	C	M	14	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	3	3
35	A	M	A	3	0	0	0	0	4	0	0	0	0	0	0	0	0	0	7	0	7
35	A	F	A	1	0	0	3	0	1	0	0	0	0	0	0	0	0	0	5	0	5
35	C	M	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1
35	C	F	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	A	M	A	1	0	0	0	0	3	0	0	0	0	0	0	1	0	0	4	1	5
36	A	F	A	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3	0	3
36	C	M	6	1	0	0	2	0	0	0	0	0	0	1	0	0	0	0	3	1	4
36	C	M	10	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	2
36	C	F	13	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
40	A	M	A	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	3	0	3
40	A	F	A	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2
40	C	M	9	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	2
40	C	M	13	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
40	C	F	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	A	F	A	1	1	0	0	0	1	0	0	0	2	0	0	0	0	0	3	2	5
42	C	F	11	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	2
42	C	F	13	2	0	0	0	0	1	0	0	0	0	0	1	0	0	0	3	1	4
43	A	M	A	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0	3
43	A	F	A	2	0	0	0	1	0	0	1	0	0	0	0	0	0	0	4	0	4
43	C	M	9	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	2
44	A	M	A	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
44	A	F	A	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	2
44	C	M	10	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1
55	C	M	9	1	0	0	0	0	0	2	0	0	0	0	1	0	0	0	3	1	4
55	C	F	7	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1
57	A	M	A	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	3	0	3
57	C	F	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	C	F	15	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	3	0	3

Table N-vi Analysis of the Follow-Up Interview subjects' feelings exhibit memories.

				Pleasure					Wonder			Displeasure		Difficulty		Misgiving		Total	Total	Grand
Group	Adult/ Child	Sex	Age	Enjoyment	Satisfaction	Amusement	Affection	Clarity	Fascination	Surprise	Challenge	Annoyance	Dis-satisfaction	Dislike	Difficult	Boring	Worry	Avoid	Positive	Negative	Total
70	A	F	A	0	0	0	0	1	3	0	1	0	0	0	0	0	0	0	5	0	5
70	C	M	15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
70	C	F	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	A	M	A	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	4	0	4
72	A	F	A	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
72	C	M	8	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	2
74	A	F	A	0	0	0	1	0	2	0	0	1	0	0	0	0	0	0	3	1	4
74	C	M	9	0	0	0	3	0	0	0	0	0	0	2	0	0	0	0	3	2	5
74	C	M	10	1	0	0	2	0	0	0	0	1	0	1	0	0	0	0	3	1	4
83	A	F	A	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	1	4
92	A	M	A	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	3	1	4
92	C	M	14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1
92	C	F	11	3	0	1	2	0	1	0	1	0	0	0	0	0	0	0	8	0	8
97	A	M	A	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2
97	A	F	A	0	0	0	0	0	1	1	0	0	0	0	0	2	0	1	2	3	5
97	C	F	12	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	2
101	A	M	A	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	2	3
101	A	F	A	0	0	2	0	0	0	1	0	0	0	0	1	0	1	0	3	3	6
101	C	M	9	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	1	2	3
101	C	M	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
101	C	F	14	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	2	2	4
103	A	M	A	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	3
103	A	F	A	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	2
103	C	M	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	C	F	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	A	F	A	0	1	0	0	0	2	0	0	0	0	0	1	0	1	0	3	2	5
107	C	F	10	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	2
107	C	F	12	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	2	1	3
TOTALS				29	3	11	36	10	47	12	5	6	10	10	16	7	4	3	153	56	209
percentages				14	1	5	17	5	22	6	2	3	5	5	8	3	2	1	73	27	100
Total Number of Feelings =										209											

Table N-vii Analysis of the Follow-Up Interview subjects' thoughts exhibit memories.

				Explanation			Effect		Application		Related				Learning		Understanding			
Group	Adult/ Child	Sex	Age	None	Accurate	Inaccurate	None	Accurate	Relevant	Not Relevant	Hobby/Toy	School	TV	Other	Some	None	None	Accurate	Inaccurate	Incomplete
19	A	F	A	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
19	C	M	8	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
19	C	F	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	A	F	A	0	2	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0
20	C	F	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
20	C	F	11	0	0	0	1	2	0	0	1	0	0	2	0	0	2	1	0	0
27	A	F	A	1	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0
27	C	F	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	C	F	12	1	0	0	0	2	0	0	0	2	1	0	0	0	1	0	0	0
28	A	M	A	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0
28	A	F	A	0	0	0	0	5	0	0	0	0	0	0	0	0	4	0	1	0
28	C	M	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
29	A	F	A	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	0	0
29	C	M	8	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
30	A	M	A	0	0	1	0	0	0	0	0	0	0	0	0	0	2	1	0	0
30	C	F	13	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0
30	A	F	A	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0
30	C	F	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
31	A	M	A	2	0	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0
31	A	F	A	0	0	0	0	1	0	0	0	0	3	0	1	0	1	0	0	0
31	C	M	8	0	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0
31	C	M	12	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
35	C	M	14	1	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0
35	A	M	A	0	0	0	0	3	0	0	1	1	0	1	0	0	0	1	0	1
35	A	F	A	0	0	0	0	3	0	0	2	0	0	2	0	0	1	0	0	0
35	C	M	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	C	F	8	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
36	A	M	A	1	0	1	0	1	0	0	0	0	0	1	0	0	1	0	0	1
36	A	F	A	0	0	0	0	1	0	0	1	0	0	1	0	0	1	1	0	0
36	C	M	6	1	0	1	0	2	0	0	0	0	0	2	0	0	1	0	0	0
36	C	F	10	0	0	0	0	2	0	1	0	0	1	0	0	0	2	0	0	0
36	C	F	13	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0
40	A	M	A	0	1	0	1	0	0	0	0	0	0	1	0	0	0	2	0	0
40	A	F	A	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	0
40	C	M	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	C	M	13	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
40	C	F	8	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
42	A	F	A	1	1	0	0	2	0	0	0	0	1	0	2	0	1	0	0	0
42	C	F	11	0	1	0	1	2	0	0	0	1	0	0	0	0	1	0	0	0
42	C	F	13	0	1	0	0	3	0	0	0	1	1	2	0	0	2	1	0	0
43	A	M	A	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0
43	A	F	A	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0
43	C	M	9	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
44	A	M	A	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0
44	A	F	A	0	3	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0
44	C	M	10	0	0	0	0	2	0	0	0	1	0	1	0	0	1	0	0	0
55	C	M	9	0	0	0	0	2	0	0	0	0	2	0	0	0	3	2	0	0
55	C	F	7	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0
57	A	M	A	1	2	0	0	4	0	0	0	0	0	0	1	1	0	0	0	0
57	C	F	10	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
57	C	F	15	0	0	1	0	2	0	0	0	0	1	0	0	0	1	1	0	0

Table N-vii Analysis of the Follow-Up Interview subjects' thoughts exhibit memories.

				Explanation			Effect			Application		Related				Learning		Understanding			
Group	Adult/ Child	Sex	Age	None	Accurate	Inaccurate	None	Accurate	Inaccurate	Relevant	Not Relevant	Hobby/Toy	School	TV	Other	Some	None	None	Accurate	Inaccurate	Incomplete
70	A	F	A	1	1	0	0	2	0	0	0	1	0	0	2	1	0	1	0	0	0
70	C	M	15	0	0	0	0	1	1	0	0	0	1	0	1	0	0	2	0	0	1
70	C	F	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	A	M	A	0	3	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0
72	A	F	A	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	C	M	8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
74	A	F	A	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1
74	C	M	9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
74	C	M	10	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	1	0	0
83	A	F	A	0	0	0	0	4	0	0	0	0	4	0	0	0	0	0	0	0	0
92	A	M	A	1	0	0	0	3	0	0	0	0	0	0	2	0	0	0	0	0	0
92	C	M	14	1	0	1	0	5	0	0	0	0	1	1	2	0	0	1	0	0	1
92	C	F	11	0	0	0	1	2	0	0	0	0	1	2	3	0	0	2	1	0	0
97	A	M	A	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	2	0	0
97	A	F	A	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2	2	0	1
97	C	F	12	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0
101	A	M	A	0	2	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0
101	A	F	A	0	0	0	0	3	0	0	0	1	0	0	2	0	0	1	0	0	0
101	C	M	9	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
101	C	M	11	0	1	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0
101	C	F	14	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0
103	A	M	A	0	1	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0
103	A	F	A	0	2	0	0	3	0	0	0	2	1	0	0	0	1	0	0	0	0
103	C	M	6	0	0	0	0	3	2	0	0	0	0	1	0	0	0	0	0	0	0
111	C	F	H	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
117	A	F	A	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
107	C	F	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	C	F	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
TOTALS				13	25	6	7	113	6	2	1	12	16	23	34	9	3	65	28	4	8
percentages				3	7	2	2	30	2	1	0	3	4	6	9	2	1	17	7	1	2
Total Number of Thoughts =										375											

***Table N-viii** Analysis of Quality of exhibit memories by age and sex.*

	ADULTS				CHILDREN			
	Males n=14		Females n=21		Males n=21		Females n=23	
Not Remembered	65	22	92	21	48	10	92	19
	4.6		*4.4*		*2.3*		*4.0*	
Mention Only	89	29	127	28	184	39	145	30
	6.4		*6.0*		*8.8*		*6.3*	
Elaborate - Clear	138	46	213	48	236	50	231	49
	9.9		*10.1*		*11.2*		*10.0*	
Elaborate - Less Clear	8	3	15	3	6	1	10	2
	0.6		*0.7*		*0.3*		*0.4*	
Total	300		447		474		478	
	21.4		*21.3*		*22.6*		*20.8*	

N.B. Figures in italics show the average number of exhibit memories recalled by a subject in each category.

***Table N-ix** Analysis of elaborated comments in broad categories by age and sex.*

	ADULTS				CHILDREN			
	Males n=14		Females n=21		Males n=21		Females n=23	
	n	%	n	%	n	%	n	%
Description	143	(54)	230	(55)	231	(64)	251	(65)
	10.2		*11.0*		*11.0*		*10.9*	
Feeling	45	(17)	73	(17)	44	(12)	46	(12)
	3.2		*3.5*		*2.1*		*2.0*	
Thought	77	(29)	119	(28)	89	(24)	88	(23)
	5.5		*5.7*		*4.2*		*3.8*	
Totals	265		422		364		385	
	18.9		*20.1*		*17.4*		*16.7*	

N.B. Figures in italics show the average number of exhibit memories recalled in each category.

Table N-x Analysis of Type of recall versus Quality by age and sex.

	ADULTS				CHILDREN			
	Male		Female		Male		Female	
	n	%	n	%	n	%	n	%
SPONTANEOUS RECALL								
Not Remembered	0	(0)	0	(0)	0	(0)	0	(0)
Mention Only	4	(5)	7	(6)	8	(6)	4	(4)
Elab Clear	74	(90)	108	(89)	121	(90)	107	(92)
Elab Less Clear	4	(5)	6	(5)	5	(4)	5	(4)
	5.9		*5.8*		*6.4*		*5.0*	
PROMPT: PERSON								
Not Remembered	2	(5)	3	(6)	0	(0)	5	(8)
Mention Only	11	(30)	13	(26)	21	(30)	12	(20)
Elab Clear	24	(65)	31	(62)	48	(70)	44	(72)
Elab Less Clear	0	(0)	3	(6)	0	(0)	0	(0)
	2.6		*2.4*		*3.3*		*2.7*	
PROMPT: PHOTOGRAPH								
Not Remembered	63	(35)	89	(32)	48	(18)	87	(29)
Mention Only	74	(41)	107	(39)	155	(57)	129	(43)
Elab Clear	40	(22)	74	(27)	67	(25)	80	(26)
Elab Less Clear	4	(2)	6	(2)	1	(0)	5	(2)
	12.9		*13.1*		*12.9*		*13.1*	

N.B. Figures in italics show the average number of exhibit memories recalled by a subject in each category.